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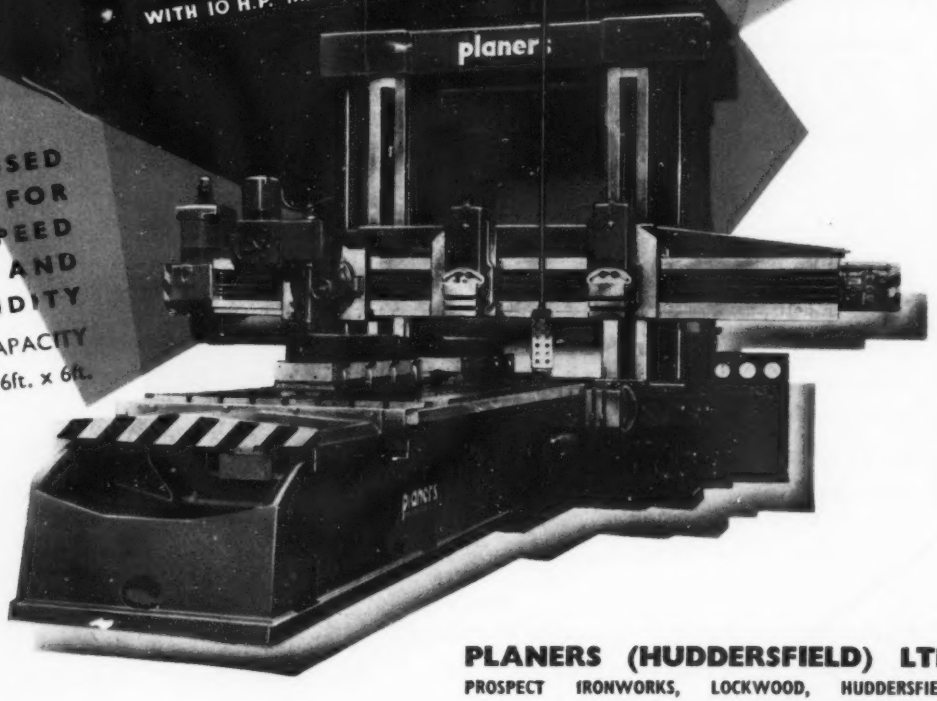

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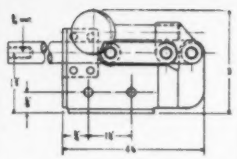
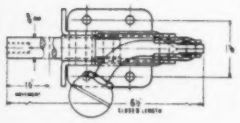


Closed position for "push" clamping. Neat and compact.



Plan view of above. Reverse position for "pull" clamping.

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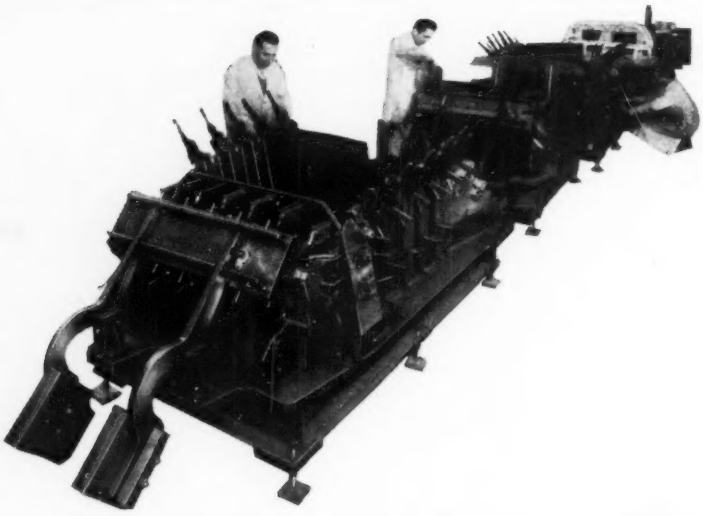

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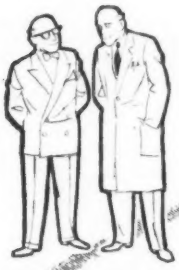

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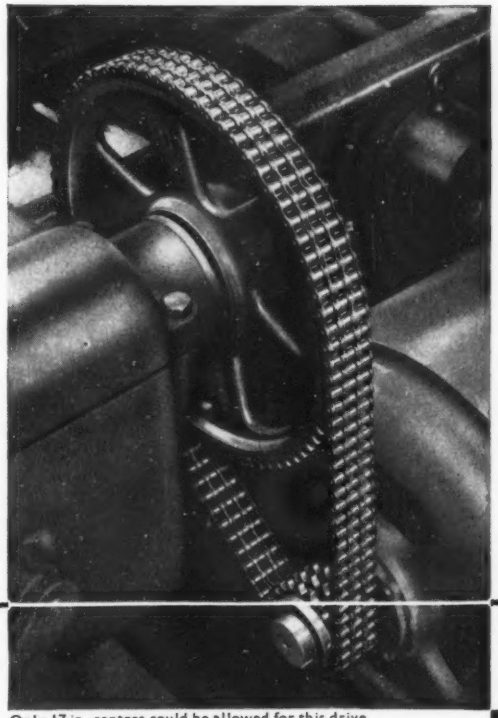

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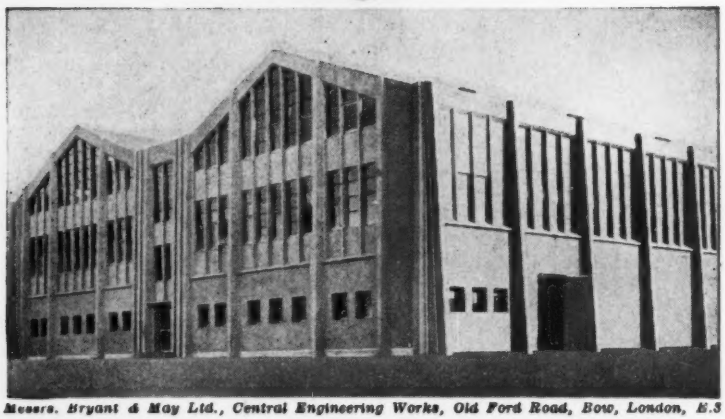

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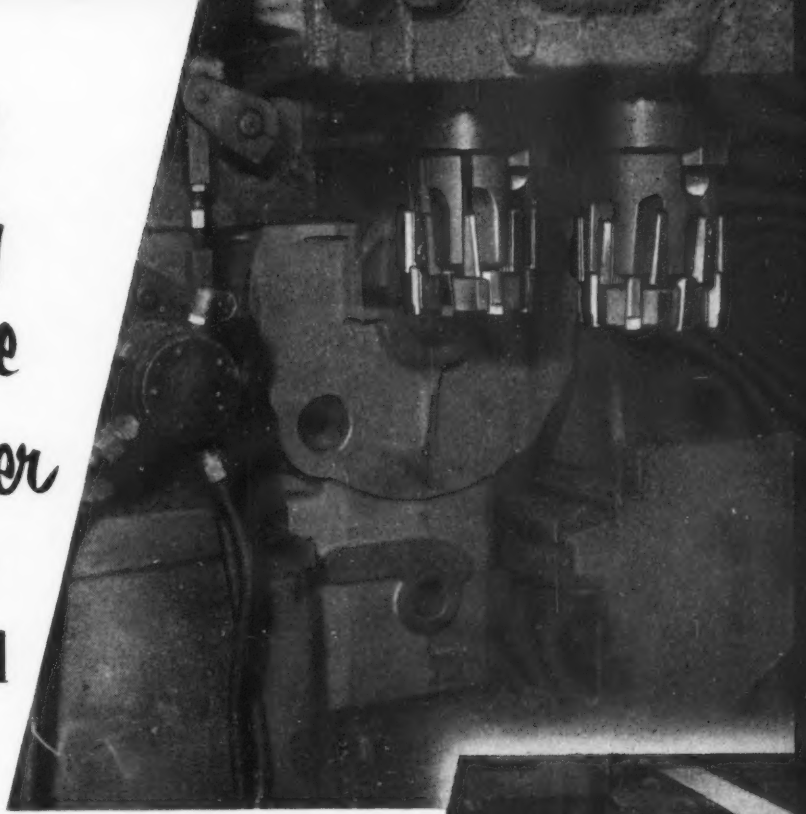

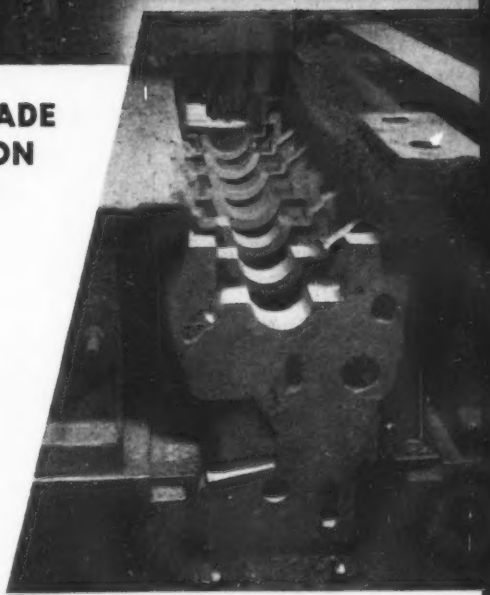

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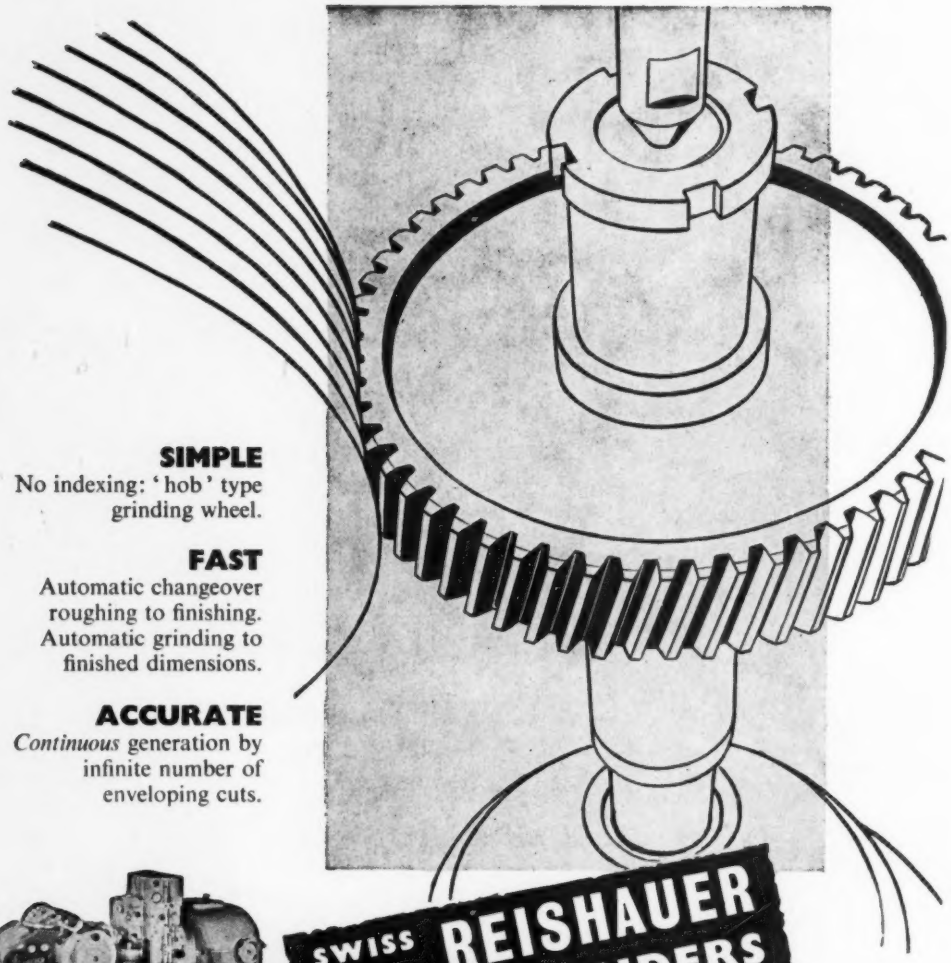

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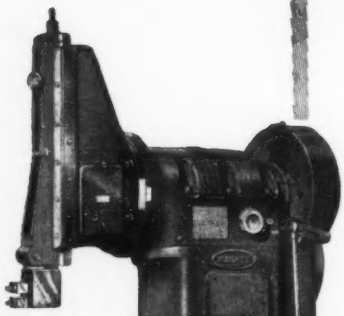
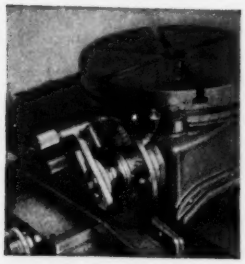
GENERAL DUTY OR TOOLROOM

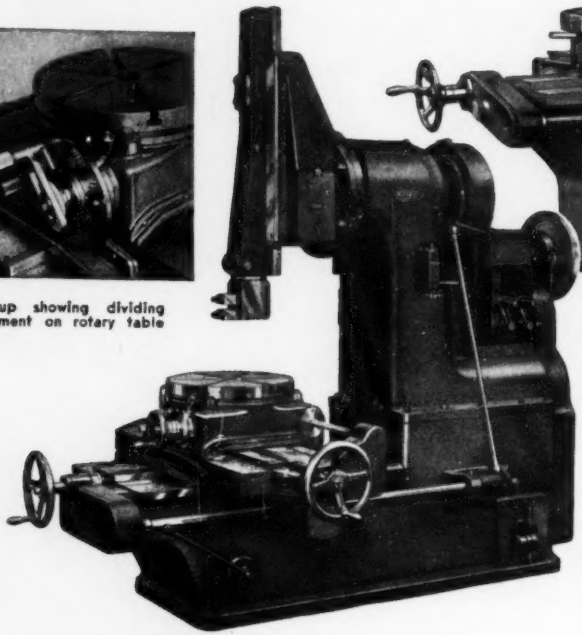
UNIVERSAL VERTICAL SHAPING & SLOTTING MACHINES

The BURDETT range for the toolroom includes high speed, versatile and accurate machines with 8", 10", 12" and 14" strokes. Tooling is uncomplicated and operation, simple. The BURDETT design features strength and rigidity, together with ample bearing surfaces, to withstand deflection under heavy loads, and preserve accuracy under the most arduous conditions of operation. The system of construction is such that all working parts are easily accessible for inspection and maintenance. The swivelling head can be inclined 10° either side of the vertical and the rotary table, which indexes 12 positions, has safety interlock of hand and power feeds. A dividing attachment can be fitted in a matter of a few minutes. The 10" model in this range is illustrated below.





Close-up showing dividing attachment on rotary table



GENERAL PURPOSE MACHINES

The machine above is available in two sizes, with 6½" and 8½" strokes. It possesses many features of the toolroom model described above but is intended primarily to accommodate the many jobs which do not require such extreme accuracy and versatility.

Full details of both types are available on application.

it's BURDETT *FOR SLOTTERS!*

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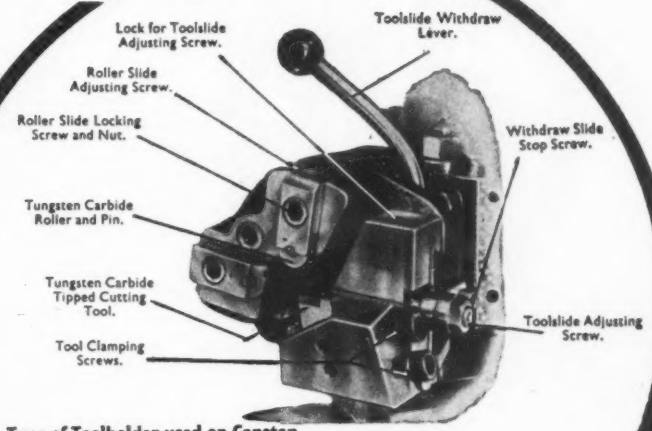
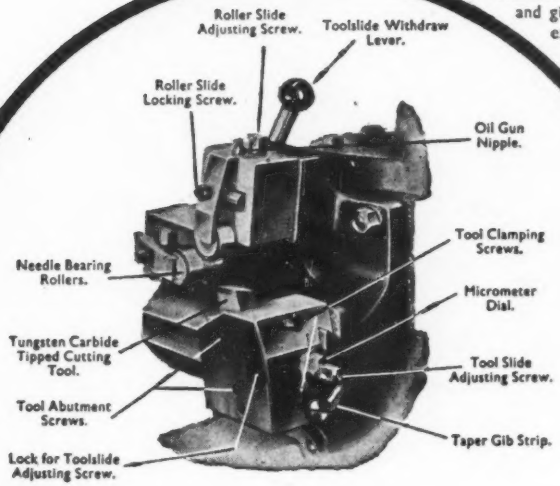

Lock for Toolslide Adjusting Screw.
Toolslide Withdraw Lever.
Roller Slide Adjusting Screw.
Roller Slide Locking Screw and Nut.
Withdraw Slide Stop Screw.
Tungsten Carbide Roller and Pin.
Tungsten Carbide Tipped Cutting Tool.
Toolslide Adjusting Screw.
Tool Clamping Screws.

Type of Toolholder used on Capstan Lathes

Toolholders for capstan lathes have long-life tungsten-carbide rollers and pins allowing maximum speeds to be used without danger of seizure and giving the work an excellent burnished finish.



Type of Toolholder for Turret Lathes

Toolholders for turret lathes have rollers mounted on anti-friction needle bearings and the roller slides have provision for oil gun lubrication.

Constructed for use with tungsten-carbide tools, these holders present the tool tangentially to the work in a quickly set robust slide having micrometer adjustment. Tool relief on return stroke obviates marking work.

MOST SIZES FROM STOCK OR EARLY DELIVERY

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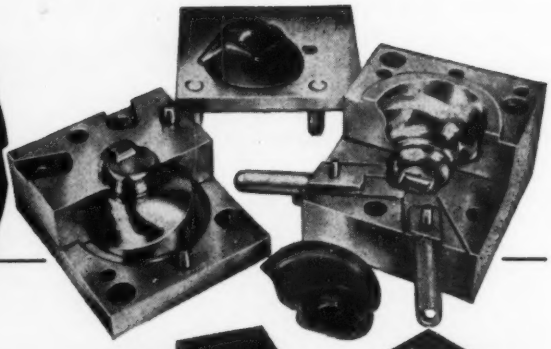

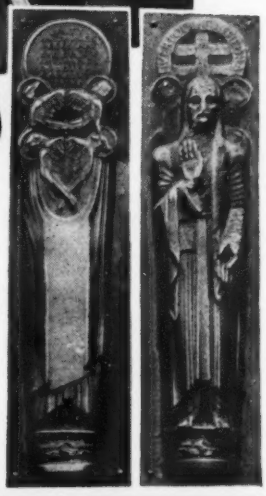

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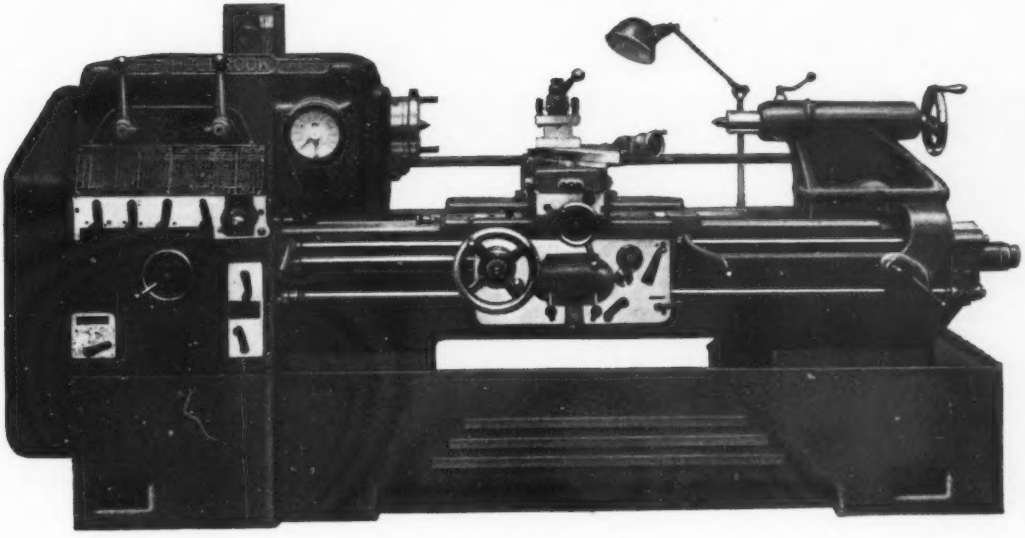

MODEL " U " No. 17

MODEL "U"

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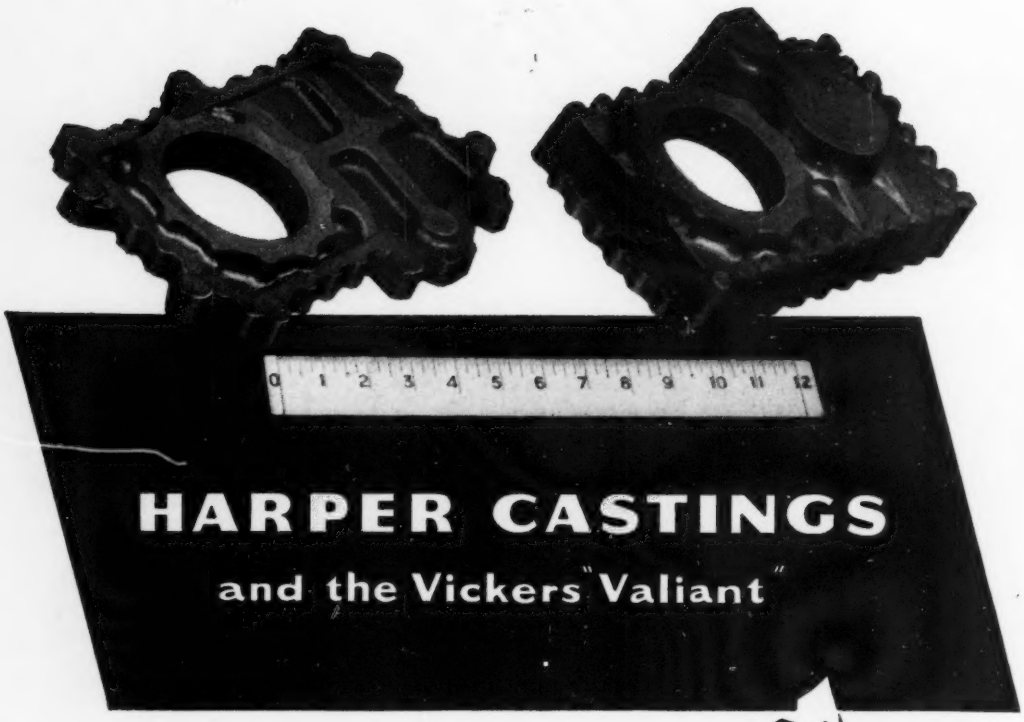

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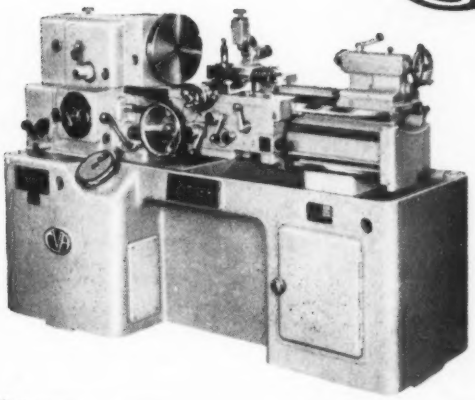

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For high surface finish but at the same time, rapid stock removal. The Model 1A swings 12½" over the bed and has 30" between centres. Speeds between 25 and 3,100 r.p.m. are available. Power is transmitted from a 4 h.p. main drive motor. Flame hardened bedways ensure continued accuracy over a long life.

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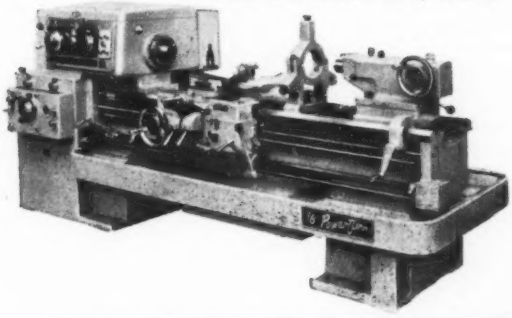

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Computing head calculates correct cutting speeds and indicates correct lever settings.

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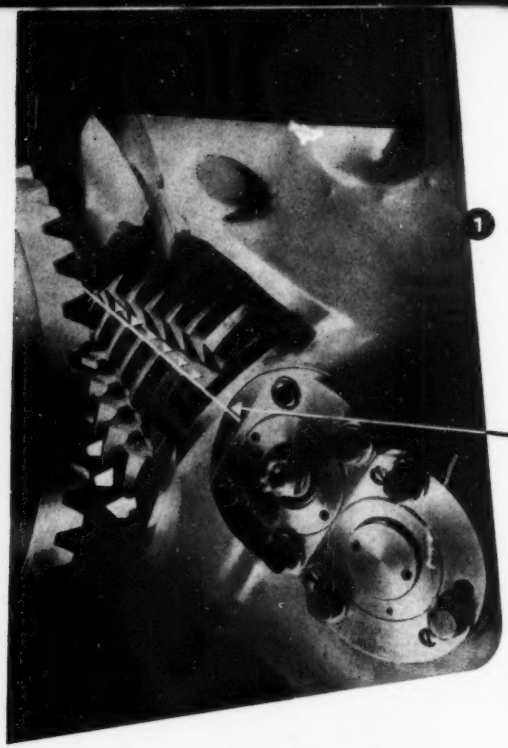

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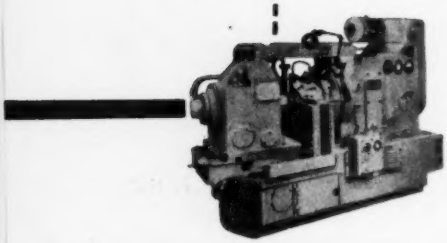

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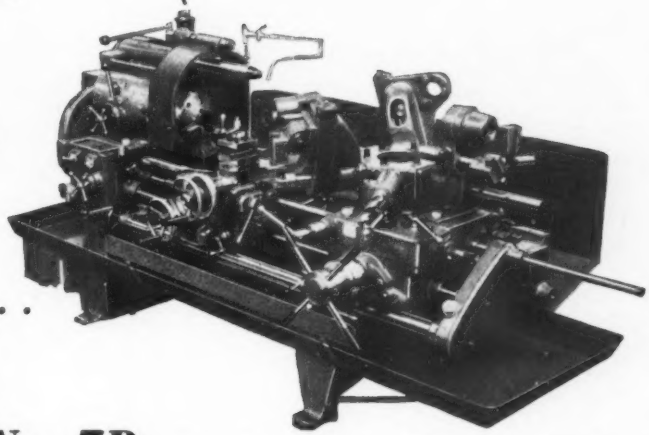
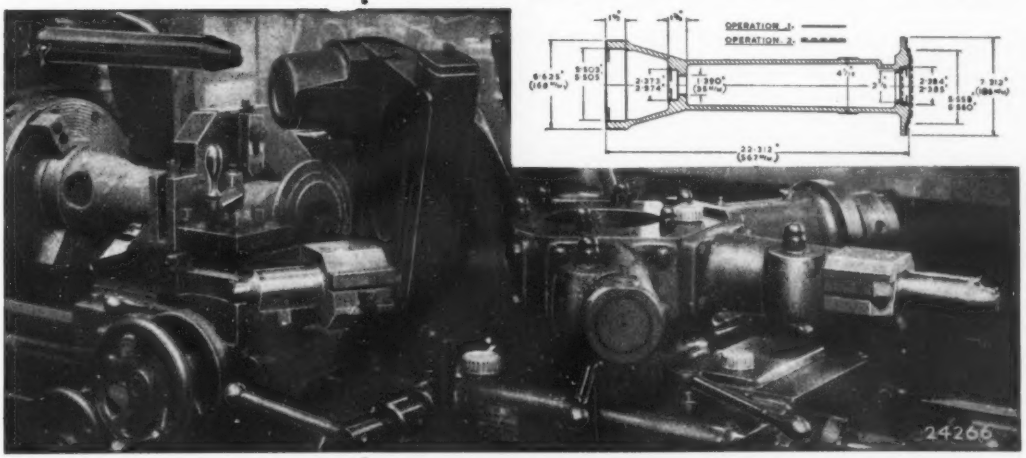


. . . *the* HERBERT No. 7B *Combination Turret Lathe*

Dial-change headstock provides eight reversible spindle speeds from 40 — 1000 r.p.m., two speeds forward and reverse obtained instantly without stopping the spindle. Wider speed range when two-speed motor is fitted.

Automatic sliding and surfacing motions to saddle. Reversible quick-power traverse and power feeds to turret slide. Power feeds to turret slide reversible independently of those to the saddle.



Tooling arrangement for machining in two operations, Automobile Gearbox Tubes from grey-iron castings, the total time being 22 minutes.

AD.243

ALFRED HERBERT LTD., COVENTRY

SIEMENS

Electromagnetic Multiple-Plate Clutches

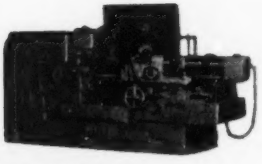
The sound design and outstanding efficiency of our electro-magnetic multi-plate clutches has ensured their wide adoption for machine drives of every type.

Multiple thin magnetic steel plates form an exceptionally compact unit, capable of transmitting very high torques. Operation is unaffected by oil and the clutches are therefore very suitable for gear box operation. No adjustment is necessary, as the clutches will function without an air gap.

TYPICAL APPLICATIONS OF OUR ELECTRO-MAGNETIC MULTI-PLATE CLUTCHES

VERTICAL MILLING MACHINE

The feeds, either forward, rapid traverse or rapid reverse, are charged by means of electro-magnetic multi-plate clutches.



TURRET LATHE

On which spindle speed changes are made through electro-magnetic multi-plate clutches.

VERTICAL TURNING AND BORING MILL

On which the electro-magnetic multi-plate clutch ensures gentle, but firm braking.

SIEMENS - SCHUCKERTWERKE A.G., BERLIN - ERLANGEN

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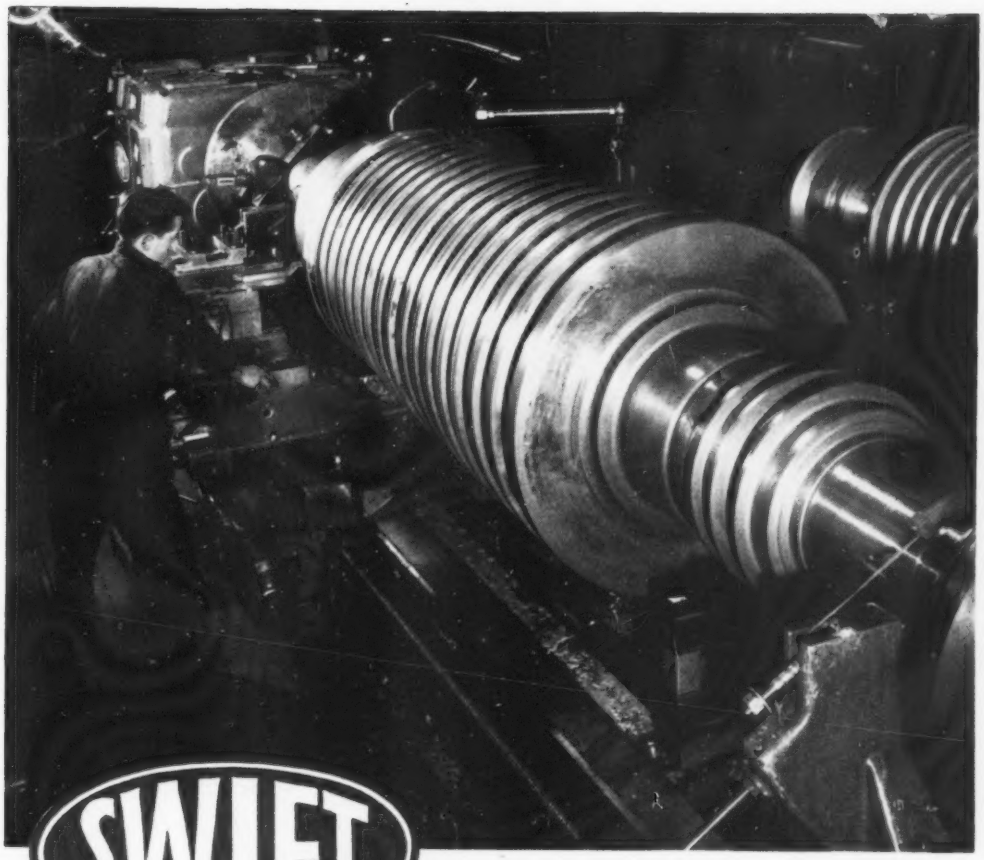

SWIFT

HEAVY DUTY LATHES

The illustration above shows a Swift Lathe employed for turning a steam turbine high-pressure rotor. Due to the intricate nature of some of the turning required on steam turbine discs, all the controls on the saddle are centralised, in order that the operator has everything to his hand, but at the same time he can carefully watch the tool. This photograph provides a demonstration of the accurate, heavy duty work these lathes are called upon to perform in numerous installations all over the country.

Swift Lathes are made in a wide range of standard types with maximum swing up to 72in. and with bed length to meet requirements.

If you have a particular turning problem or simply require a high-quality, standard, heavy-duty centre lathe, it will be worth while getting in touch with Drummond-Asquith (Sales) Ltd. For details of standard machines, write for a catalogue and mention the capacity in which you are interested.

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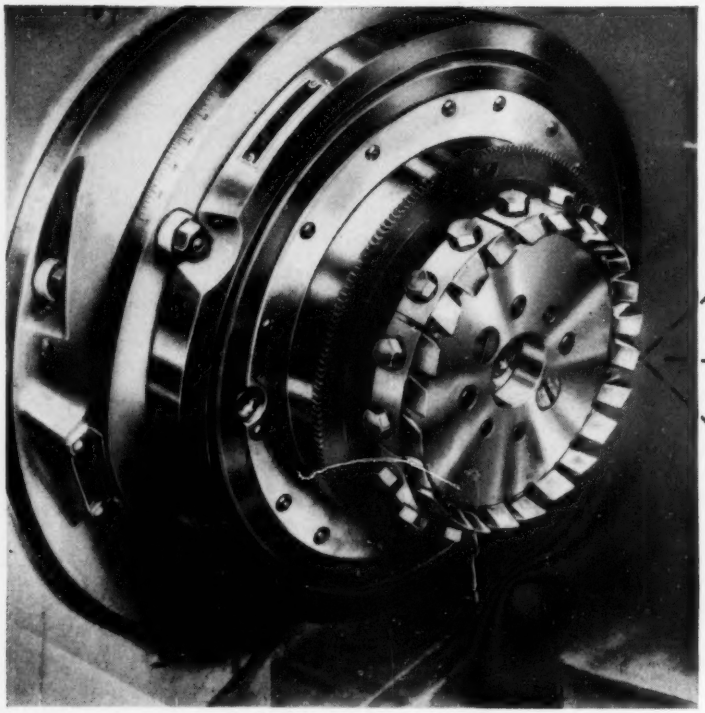
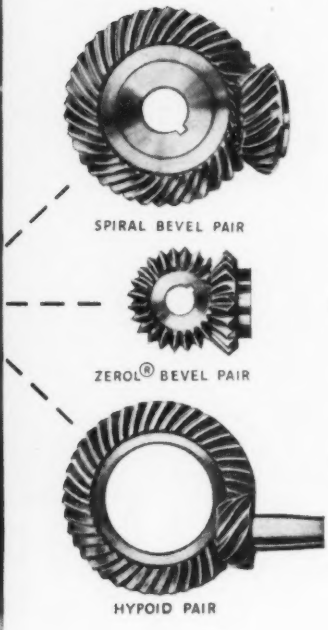
'Phone: Midland 3431 (7 lines) 'Grams: Maxishape, B'ham. Also at LONDON: Phone: Trafalgar 7224 (5 lines) and GLASGOW: 'Phone: Central 3411

WF 5024

One Generator using one cutter produced these three different gear pairs!





The new Gleason No. 116 Hypoid Generator used one Unitool Cutter to generate the three gear pairs shown above. Only five additional Unitool Cutters are needed on this generator to cut spiral and Zerol bevel gears of any ratio, and hypoid gears of 3 : 1 ratio and higher; up to 18in. pitch diameter.

The Unitool Method was developed especially for use with the No. 116 Hypoid Generator, and its smaller counterpart, the No. 106 Hypoid Generator. This new method requires only a small tooling cost to cover the entire range of both machines.

It is intended for the production of small quantities of bevel and hypoid gears, and does not replace the cutting methods now in use for mass production. When using these methods, the No. 116 Generator is substantially faster than previous models.

In addition, the new features incorporated on the No. 116 offer simplification of tooth bearing development, improved quality and much easier set-up and operation.

We shall be glad to send you information on the No. 116 Hypoid Generator and the Unitool Method for producing small quantities of bevel gears.

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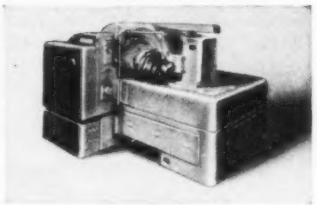
BUILDERS OF BEVEL GEAR MACHINERY FOR MORE THAN 90 YEARS



The No. 116 Hypoid Generator cuts spiral bevel, Zerol Bevel and hypoid gears up to 18in. pitch diameter, any ratio up to 10:1, any pitch 2 DP and finer.

"EaSiCut"

The right drill for your job

Standard Drills from $\frac{1}{32}$in. to 3in. diameter are available from our extensive stocks.

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Openshaw, Manchester

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We purchased this machine just over a year ago and it has been in constant use since then: it has given no trouble whatsoever,

We have the standard measuring equipment and with this we are spacing holes on jigs to ±0.0005" of nominal position.

- Spindle hardened and ground on Timken precision roller bearings.
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- Table feed, automatic 18in
- Cross feed 6½in., vertical 14½in., both hand.
- Spindle to table 15in.
- Spindle speeds 50 to 1,000 r.p.m.
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WITH POWER DOWN FEED & GAUGE BLOCK MEASURING EQUIPMENT.

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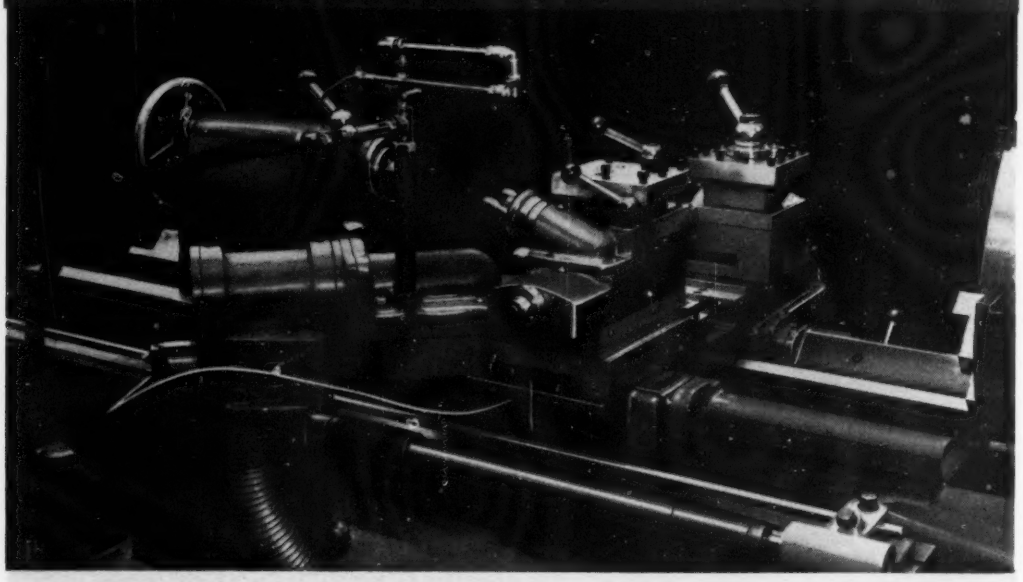
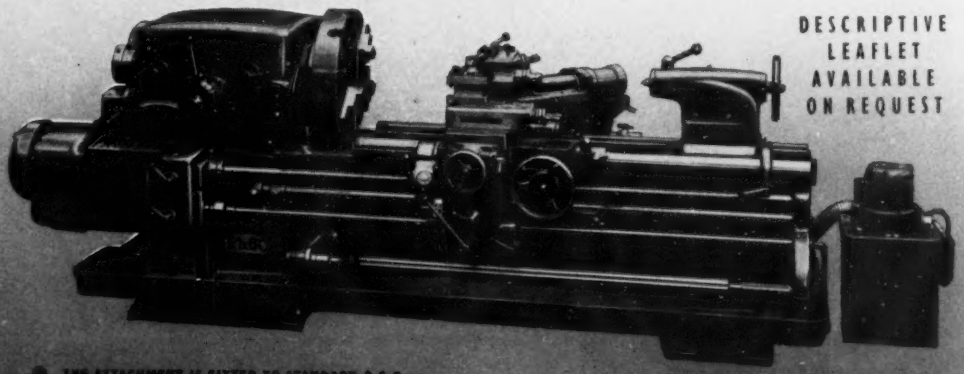


. . . is fitted here on the 21" swing engine lathe



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- THE ATTACHMENT IS FITTED TO STANDARD D.S.G. LATHES ALLOWING FRONT TOOLSLIDE TO BE USED ON NORMAL TURNING AND SCREWCUTTING OPERATIONS.
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THE "CONCENTRE"

CG2/CB COMBINED CARBIDE TOOL GRINDER

WITH MOTORIZED CHIP-BREAKER GROOVE GRINDING UNIT

EQUIPPED WITH UNIVERSAL TOOLHOLDER

The Chip-breaker Groove Grinding Unit on the Abwood CG2/CB accommodates almost every shape and size of turning tool. Its robust design allows accurate grinding of grooves of desired radius and size with extreme accuracy and perfect finish.

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The ABWOOD range of Carbide Tool Grinders includes:

MODEL No.	WHEEL SIZES	AVAILABLE WITH:
CG0	6in.	Bench or Pedestal.
CG1	8in.	—
CG2	8in.	Chipbreaker Grooving Attachment.
CG3	12in.	
CG2/CB	8in.	Motorised Chipbreaker Unit
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ABWOOD MACHINE TOOLS LTD., PRINCES RD., DARTFORD, KENT

Telephone : Dartford 5271 (5 lines) *Telegrams : ABWOOD, DARTFORD*

C9/1

You should have heard the boffins on that controversial subject the other day. Old boffin Sid for example.

He was saying that titanium satellites and nimonic space ships were fair game for SKY-ACKY welding.

"After all," he said, "saucepans, cages, bicycles, motor cars, missiles and aeroplanes are all SKY-ACKY welded."

"You mean SHE-ICKY welded" squeaked boffin Emanuel. Then all the other boffins joined in: "SHE-ACKY," "SKY-ICKY," "SHI-ARKY," "SKEE-ICKY."

I myself pronounce it *SEE-ACKY,* which is, perhaps, how any self-respecting boffin would pronounce it.

SCIAKY ELECTRIC WELDING MACHINES LIMITED, FALMOUTH ROAD, SLOUGH, BUCKS, ENGLAND. TEL: SLOUGH 25551 (10 LINES) CABLES: SCIAKYWELD, SLOUGH

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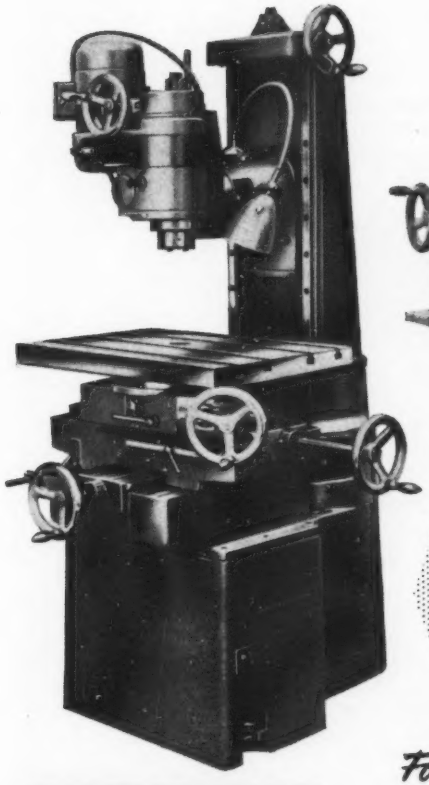
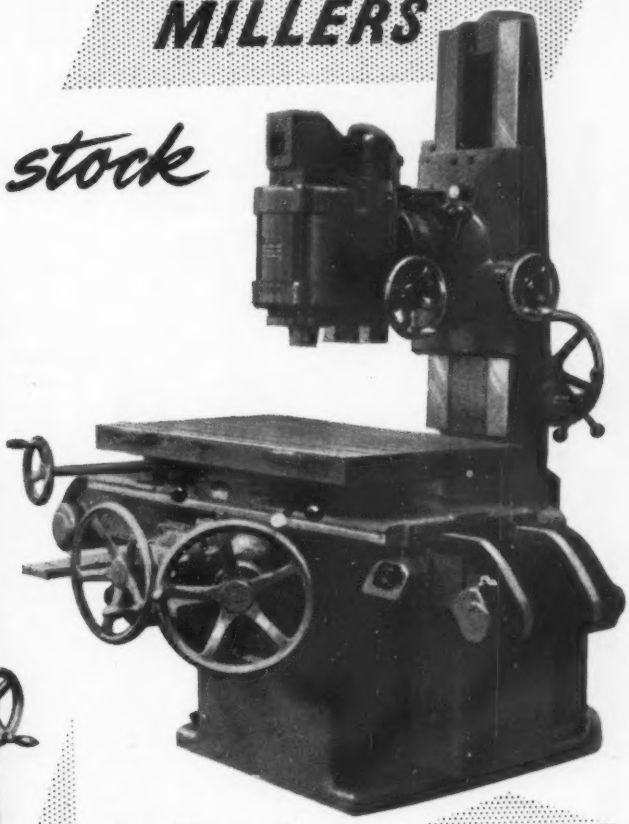
—now in stock





Model F.O. A smaller version from the popular BOKO range with work table of 27½" x 18" (swivels through 360°) a compact and sturdy universal milling machine with a wide range of uses.

The model F.I. has a 24" x 39" table which rotates through 360°. In addition to the production of Metal Patterns is most suitable for model making and machining of synthetic materials.

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MODELS B 85, 110 and 130

Table Type or Floor Type

Dia. $3\frac{3}{8}$", $4\frac{3}{8}$" or $5\frac{1}{8}$"

POSITIONING WITH OPTICAL READINGS IN .0001"

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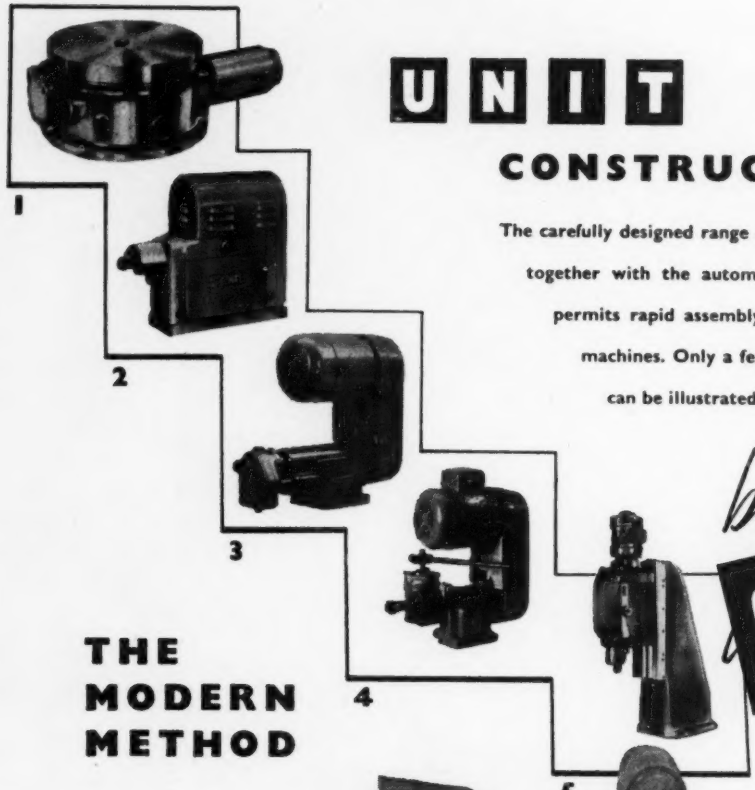
c2

UNIT CONSTRUCTION

The carefully designed range of Steinel unit heads together with the automatic indexing table, permits rapid assembly of special purpose machines. Only a few of these machines can be illustrated here.

by Steinel



THE MODERN METHOD

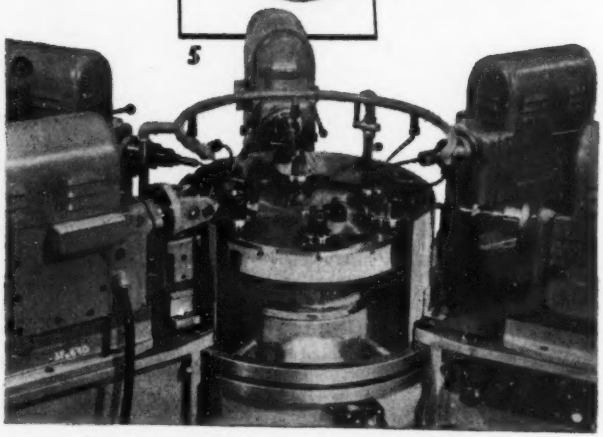
1 Automatic index table TS/315E.

2 Horizontal cam feed drilling unit BE/10VK.

3 Horizontal tapping unit GE/6N.

4 Hand lever drilling unit BE/6N.

5 Vertical cam feed drilling unit BE/10/VKS.



General view special purpose machine built from horizontal units and index table.

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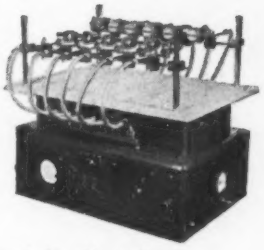
Coventry-Climax Ltd. use "PETRO-FLEX"

In these instances (above and left) "Petro-flex" is being used in the fuel lines of Coventry Climax diesel engined Fork Lift Trucks to absorb vibration.

Standard Telephones & Cables Ltd. use "PETRO-FLEX"

This Type G.100 "Stanelco" Electro-gas Heating equipment, the first of its type to be built in this country, uses "Petro-flex" to convey gas and air to its burner connections. A further set of these tubes is fitted inside the cabinet. By its ability to take up acute angles, "Petro-flex" tubing enables the equipment to maintain compact overall dimensions.



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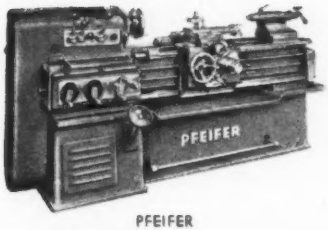
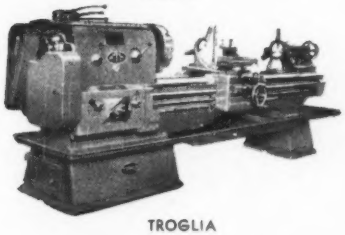
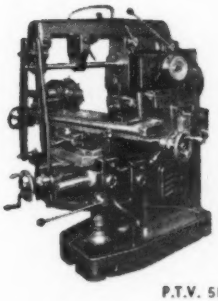
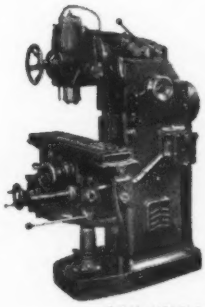


PFEIFER


TROGLIA


P.T.V. 51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9" swing by 40" between, turning accuracy 0·00008", 14 speeds 11 to 1,000 r.p.m., swings 2½" in gap, hollow mandrel 1⅝", Norton Feed Box, 187 threads, Whitworth Metric and Module, Travelling Steady, driving plate, motorised four pole motor, A.C. 415/3/50. **Price, £1,275, FROM STOCK.**
Extras: Taper Turning Attachment, Suds Pump, Fourway Toolpost, etc.

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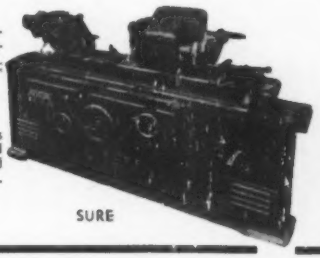
SURE UNIVERSAL GRINDER
10" swing x 40" between centres, with internal attachment, 13" dia. wheel, swivelling 90°, motorised workhead. 80-500 r.p.m., swivelling 90°, motorised A.C. 415/3/50. 10" x 40", **£1,565 0s. 0d.** 10" x 24" **£1,375 0s. 0d.** Early delivery.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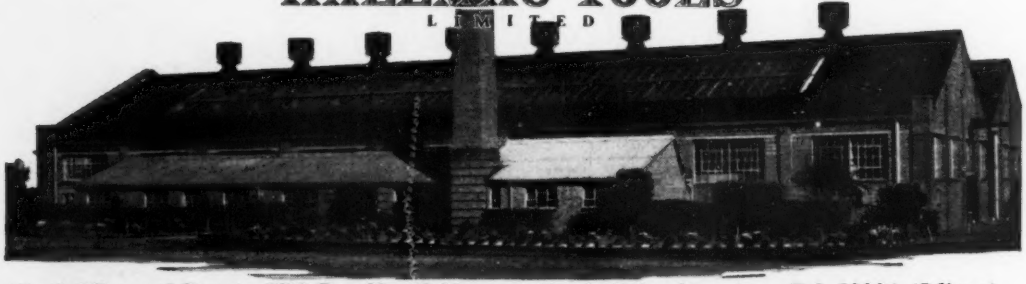

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Sizes range from 3 ft. 3 in. to 7 ft. radius for drilling up to 3" diameter in mild steel.
N.B. Our illustration shows a 5 ft. machine drilling handle attachment holes 1 37/64" diameter in driver gear housing for light overhead cranes.

Photographs by courtesy of the YALE & TOWNE Manufacturing Co., Materials Handling Division, Wednesfield, Staffs.

Manufacturers of YALE Materials Handling Equipment

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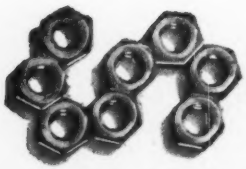

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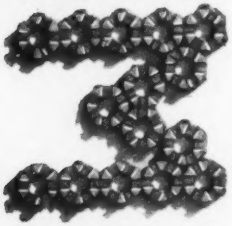
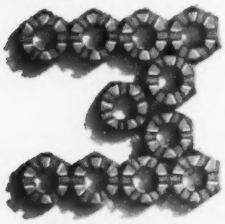
STEEL NUTS

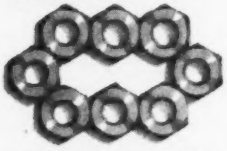
FULL NUTS



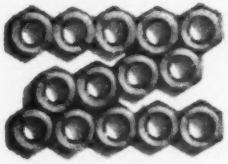
SLOTTED NUTS



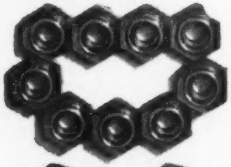
ROUND TOP
CASTLE NUTS



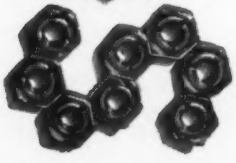
THIN LOCK NUTS



SPECIAL NUTS



ROOT NUTS



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We're not going to *say* we make the
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but we do suggest that when you're buying
Bar Turned or Cold Formed Nuts
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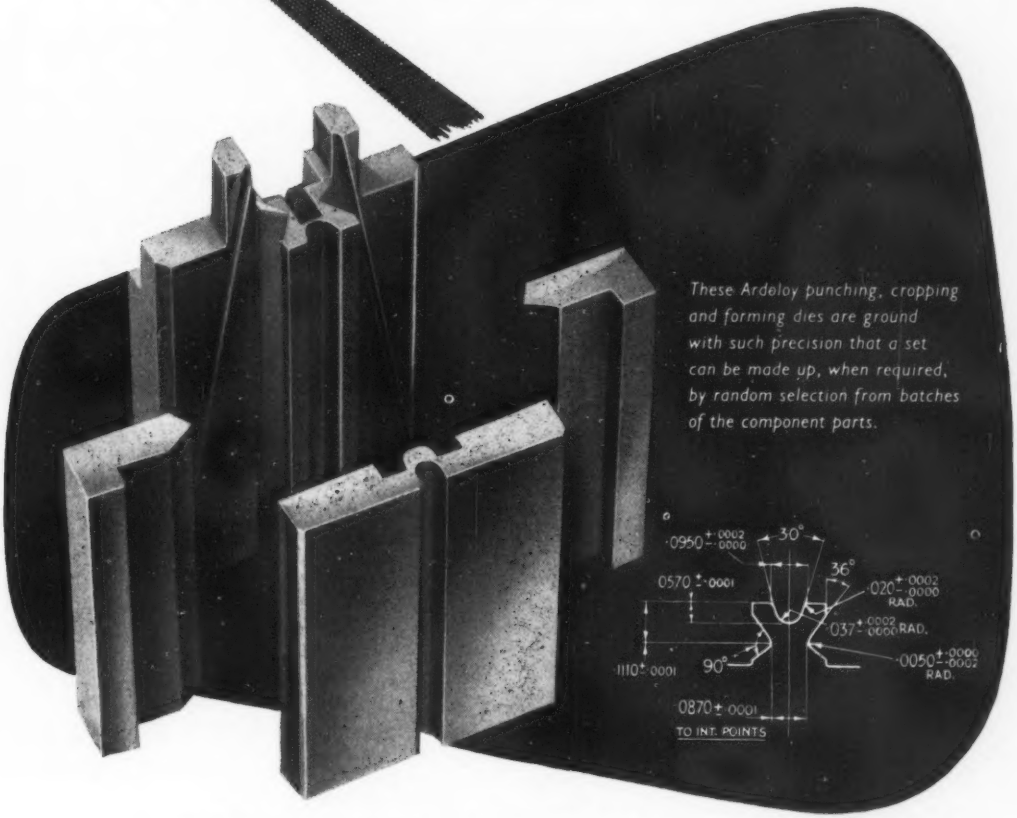

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***The* ALUMINIUM ALLOY with all these advantages**

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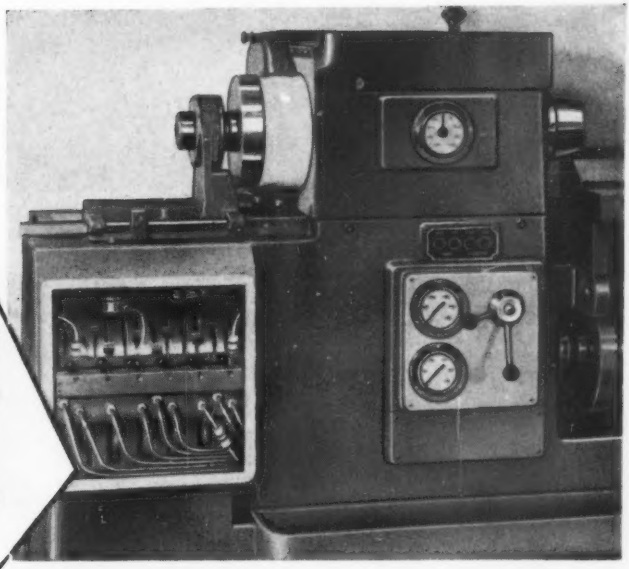

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cuts costs on short or long runs

• ADVANCED DESIGN • NEW STANDARDS OF PRODUCTIVITY • INFINITELY VARIABLE SPEED CONTROL • NO SPECIAL CAMS

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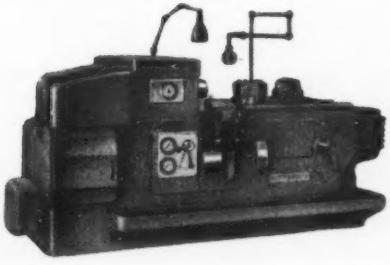

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200,000 blows per minute

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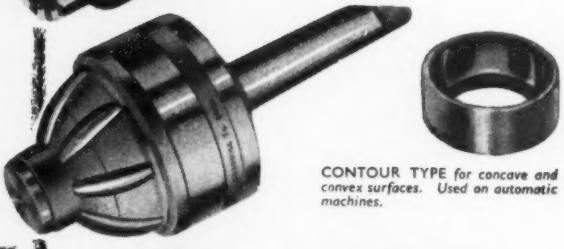
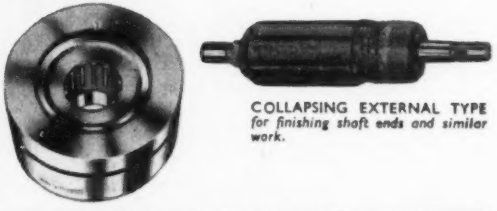


CONTOUR TYPE *for concave and convex surfaces. Used on automatic machines.*



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PRODUCES ULTRA-SURFACES NOT OBTAINABLE BY ANY OTHER FINISHING METHOD ON . . .

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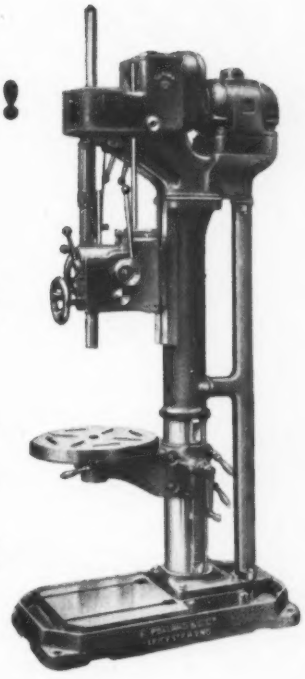

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Light Duty Vertical Round Column Machine
1¼in. Cap in M.S.

Made in 3 sizes
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Box column machines supplied in multiple form

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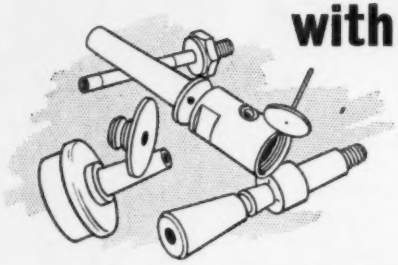
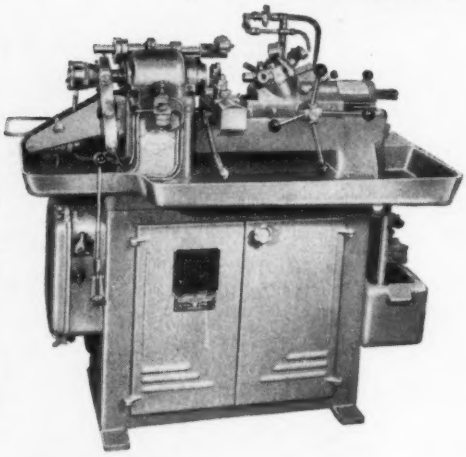


$\frac{5}{8}$" or $\frac{13}{16}$" Bar Capacity



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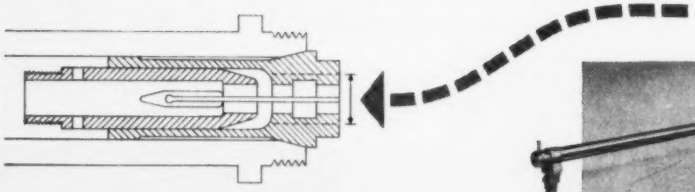

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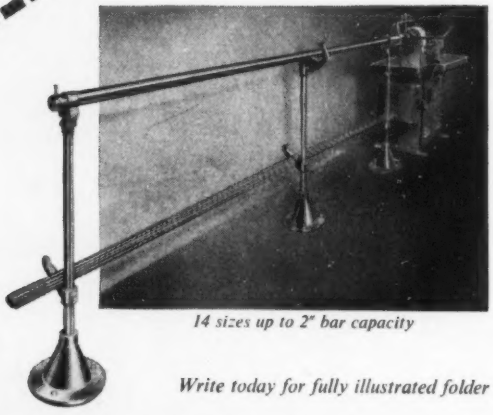

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COMBINED LIGHT and MAGNIFYING LENS UNIT

GROOVED TABLE TOP aids flush work location

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8 Speeds, 50, 75, 125, 260, 900, 1360, 2260, 4680 ft./min. Table Size, 18" x 22" · Table Tilt, 15° in four directions Max. Height of Work, 8" · Throat Depth, 12" · Range of Saw Widths, 1/16" to 5/8" · Wheel Diameter, 13" 1 H.P. Motor.

STANDARD EQUIPMENT
Built-in chip blower unit · Direct reading Saw and Speed selector · All necessary spanners and oil gun Magno-lite Unit · Butt Welder.

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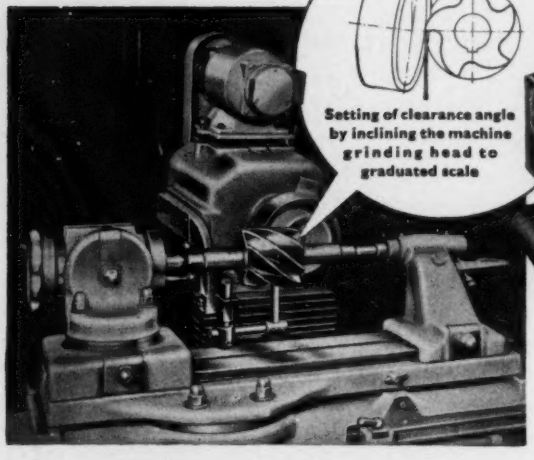
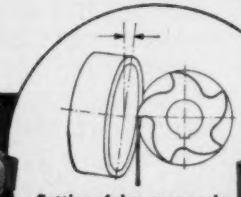
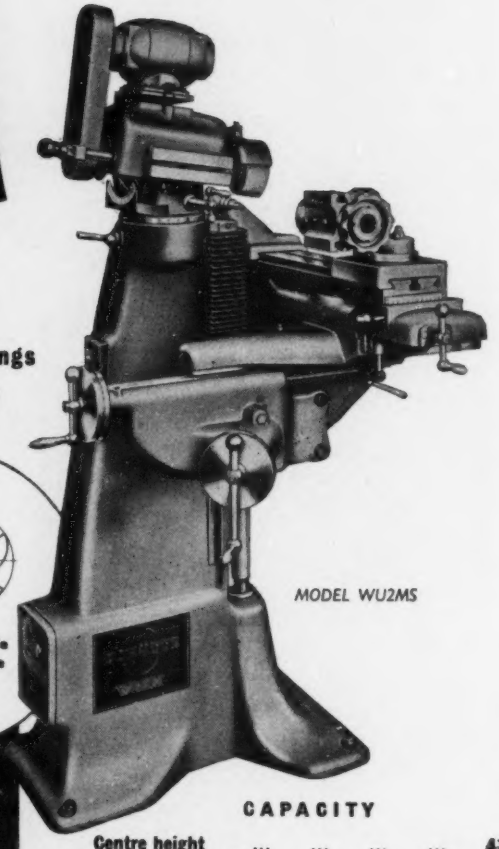




Setting of clearance angle by inclining the machine grinding head to graduated scale



MODEL WU2MS

CAPACITY

Centre height	4½"
Grinding diameter	Max. 10"
Centre distance=grinding length	12½"
Helix angle adjustment (right and left hand)	60°-0°-60°
Clearance angle inclinability ...	12°-0°-12°
2 Grinding Spindle Speeds	appr. RPM 3000/6000

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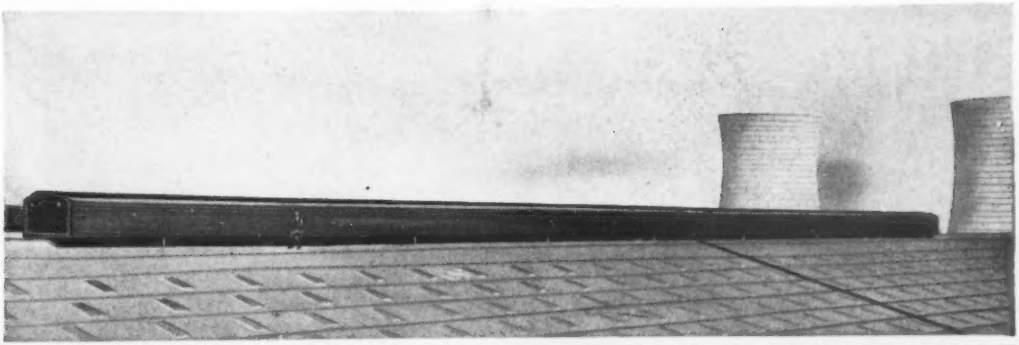

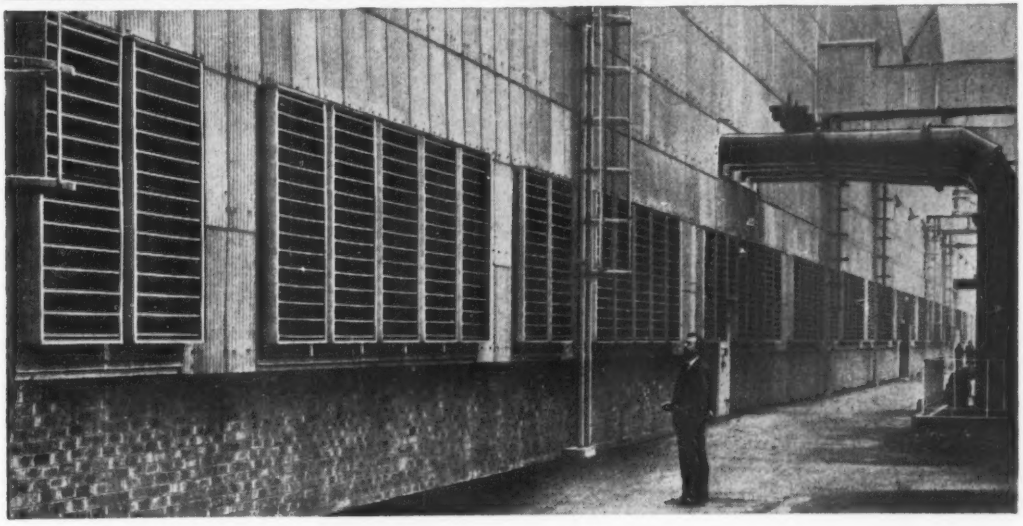

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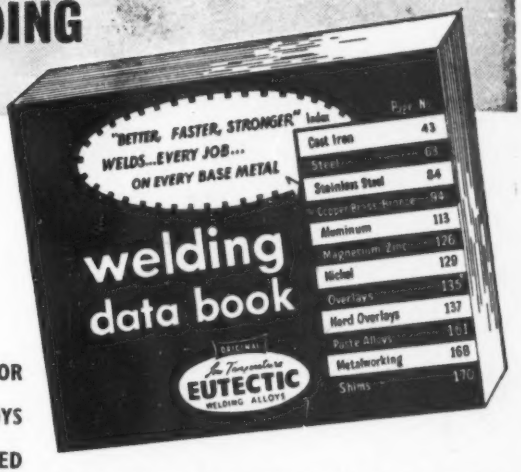

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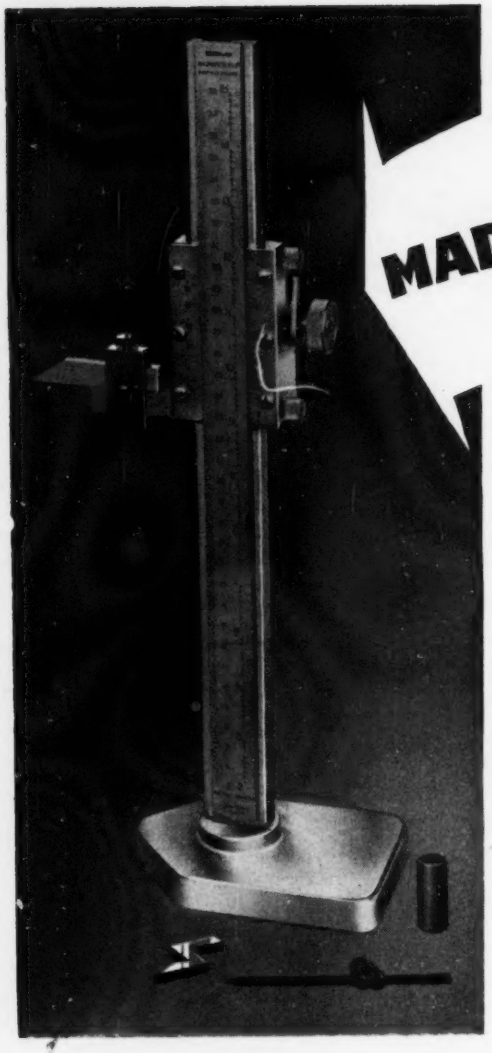

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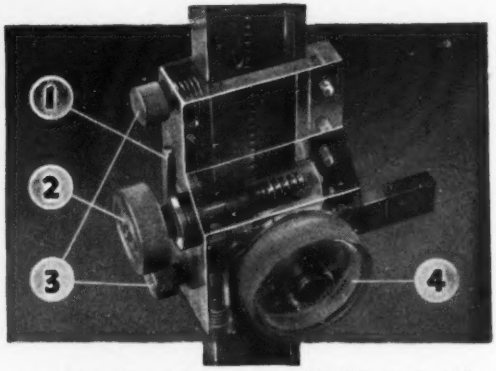

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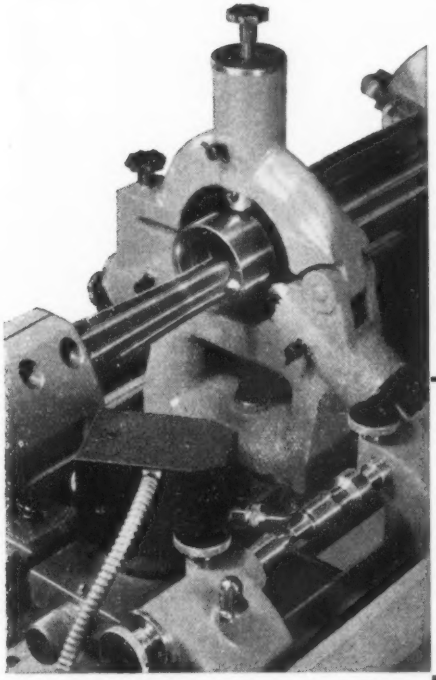

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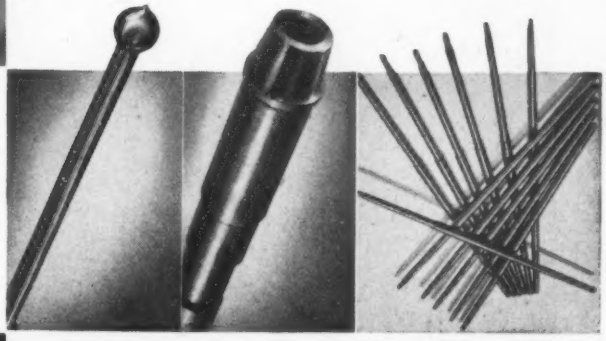

(ABOVE)
Unicop Model V3 with boring bar clamp and boring bar for internal copying of a hollow spindle.

A batch of spindles copied on a Unicop. (RIGHT)

Hollow tapered spindle copied on a Unicop. (CENTRE)

Spherically ended control rod copied on a Unicop. (LEFT)

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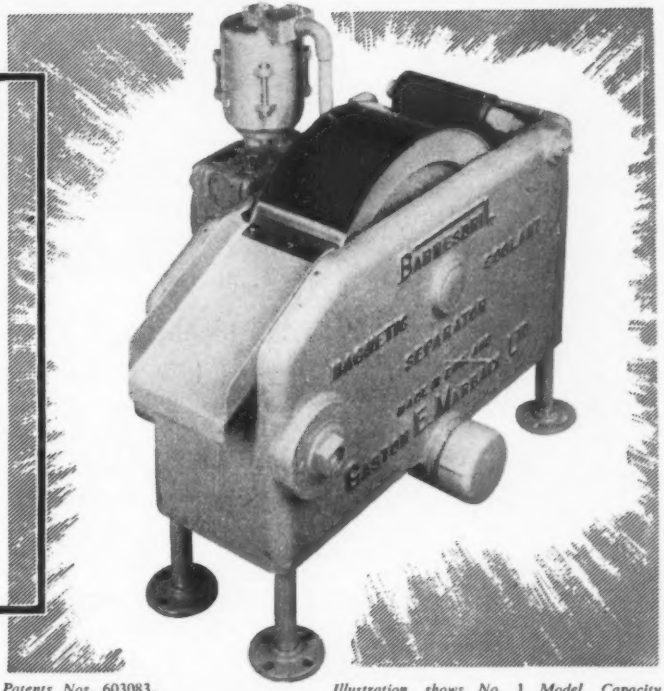

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Illustration shows No. 1 Model. Capacity 10 Imp. Galls. per min. Floor space only 27in. by. 17½in.

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Capacity ..	5	10	20	41	72	130

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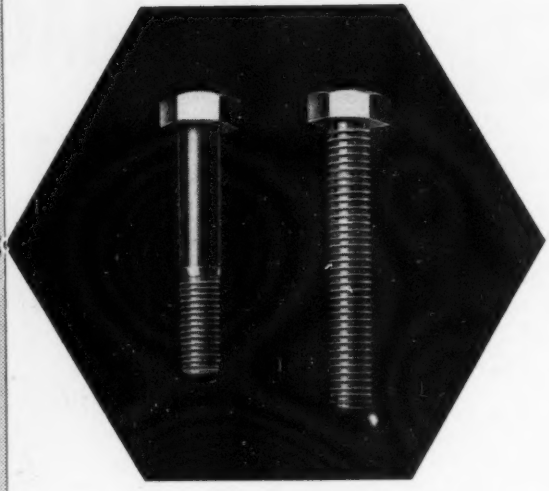

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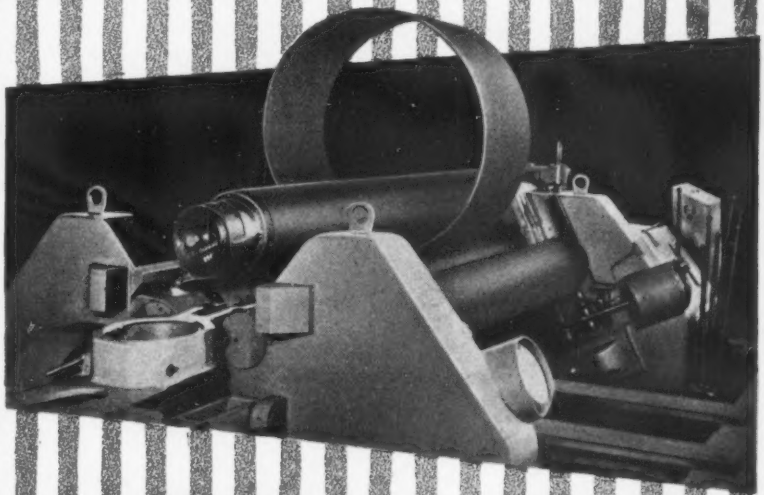

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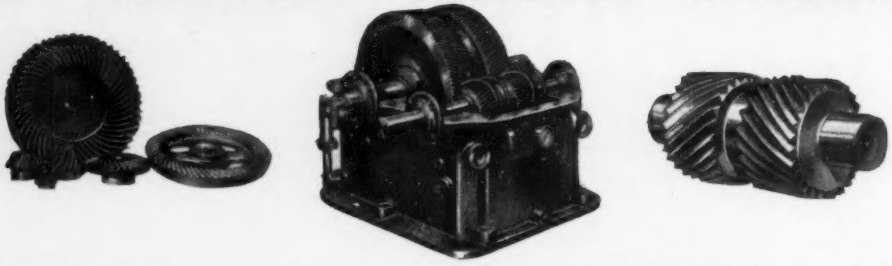

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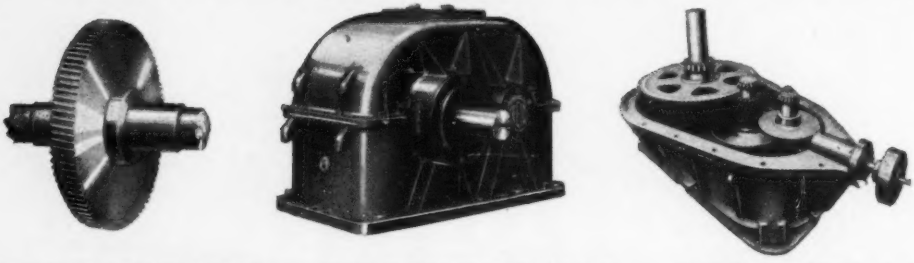

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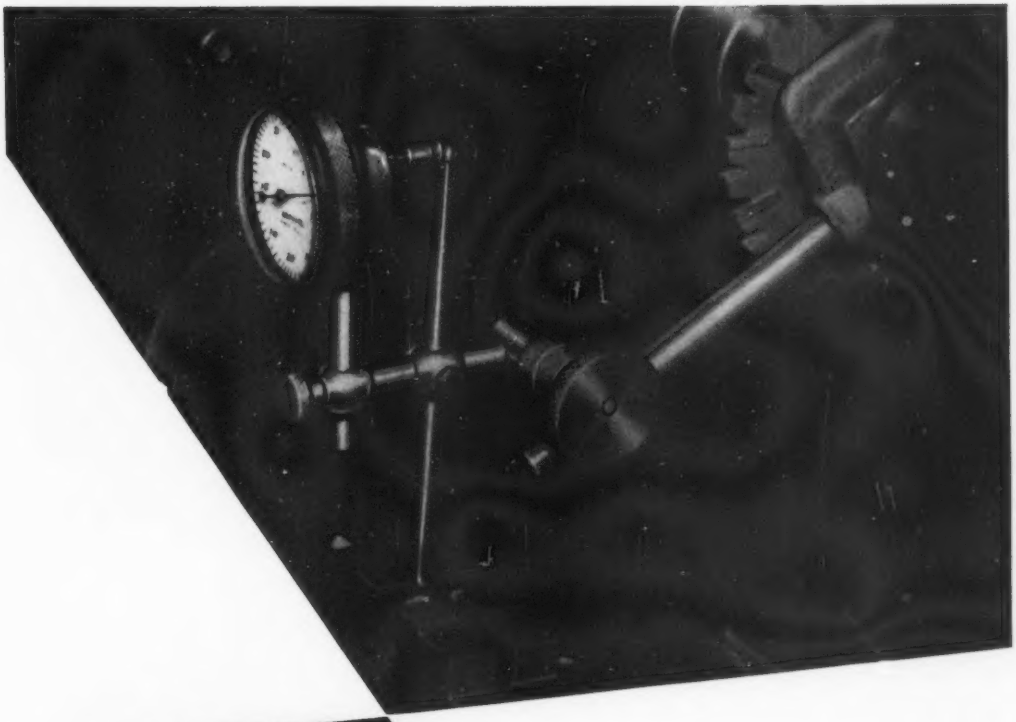

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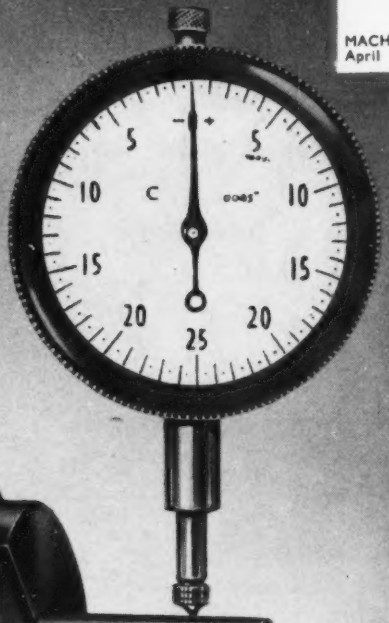

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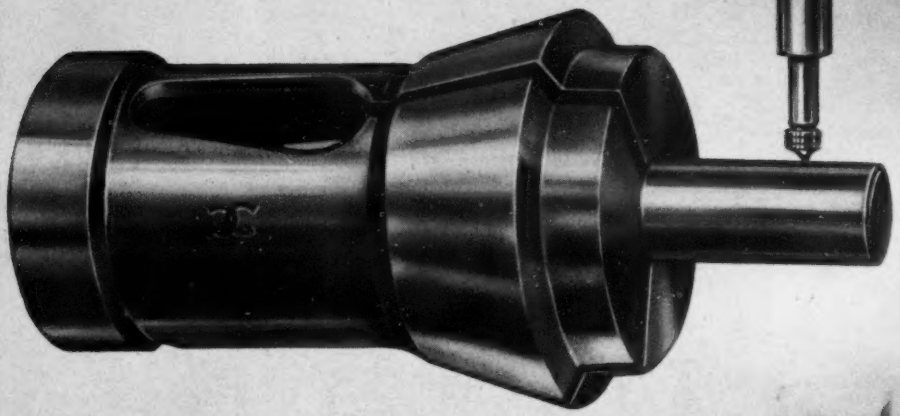

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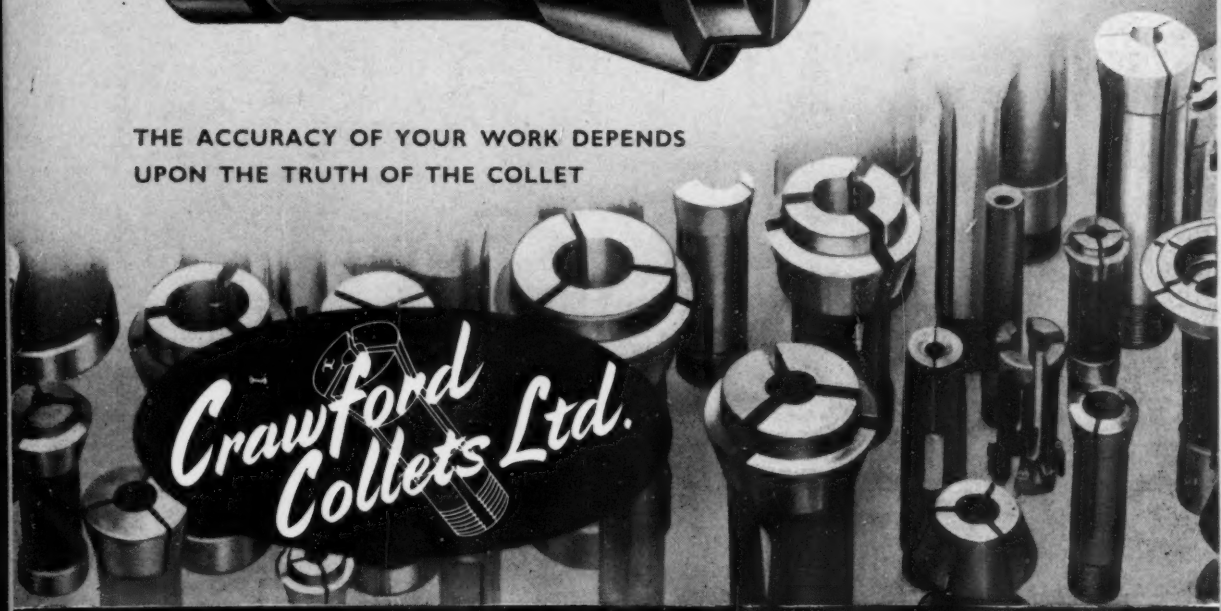

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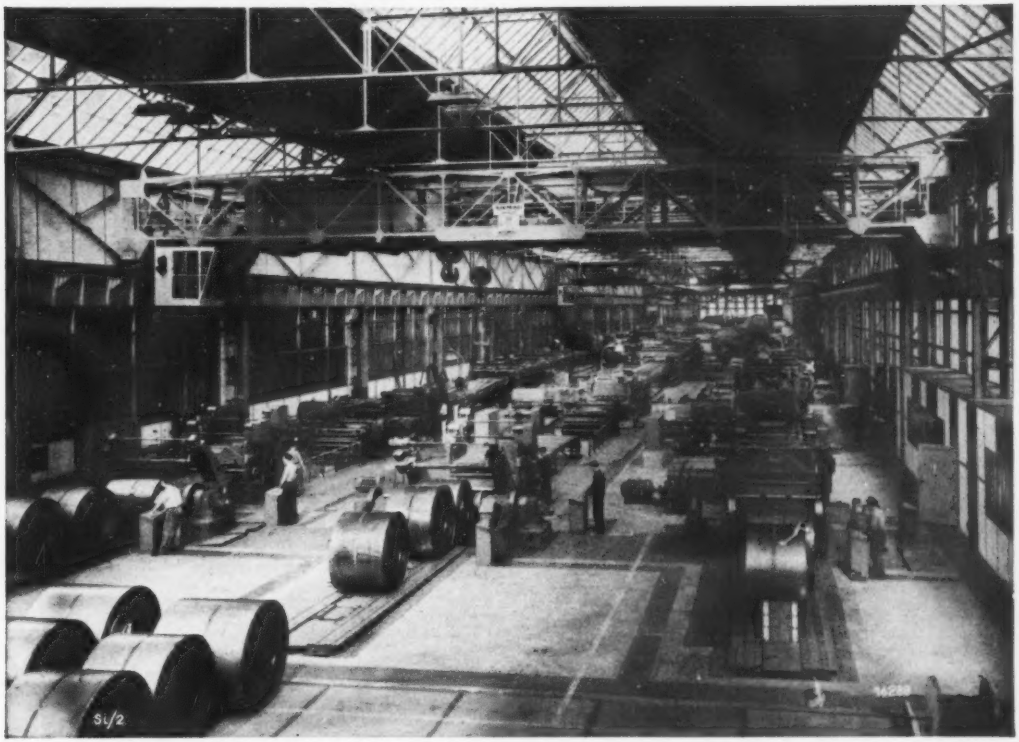

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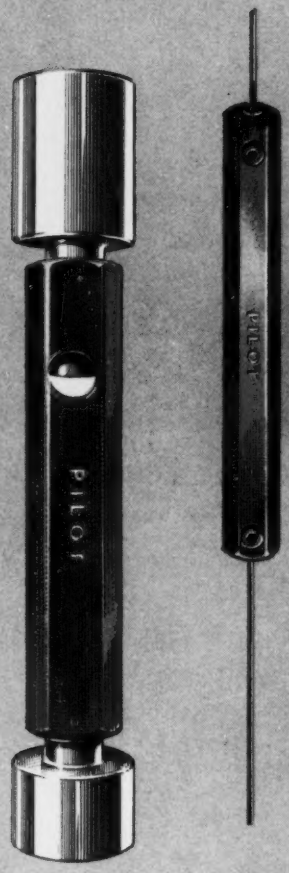

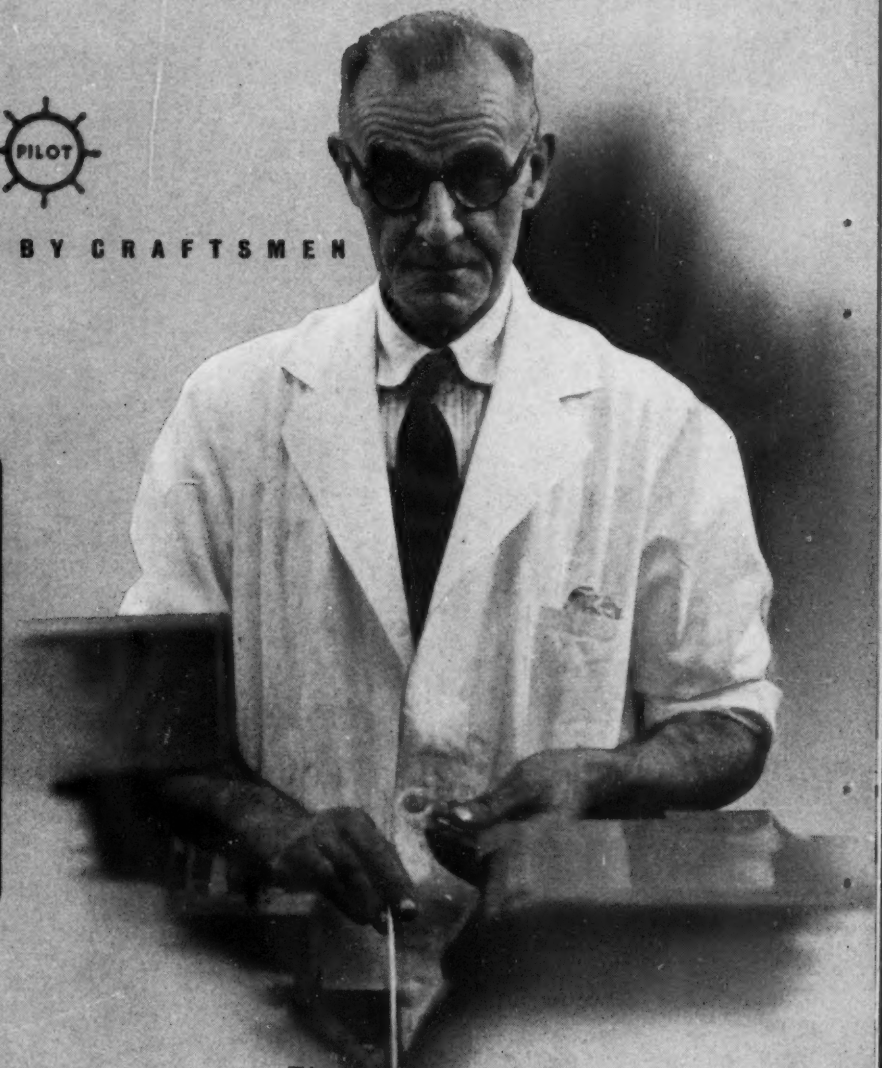

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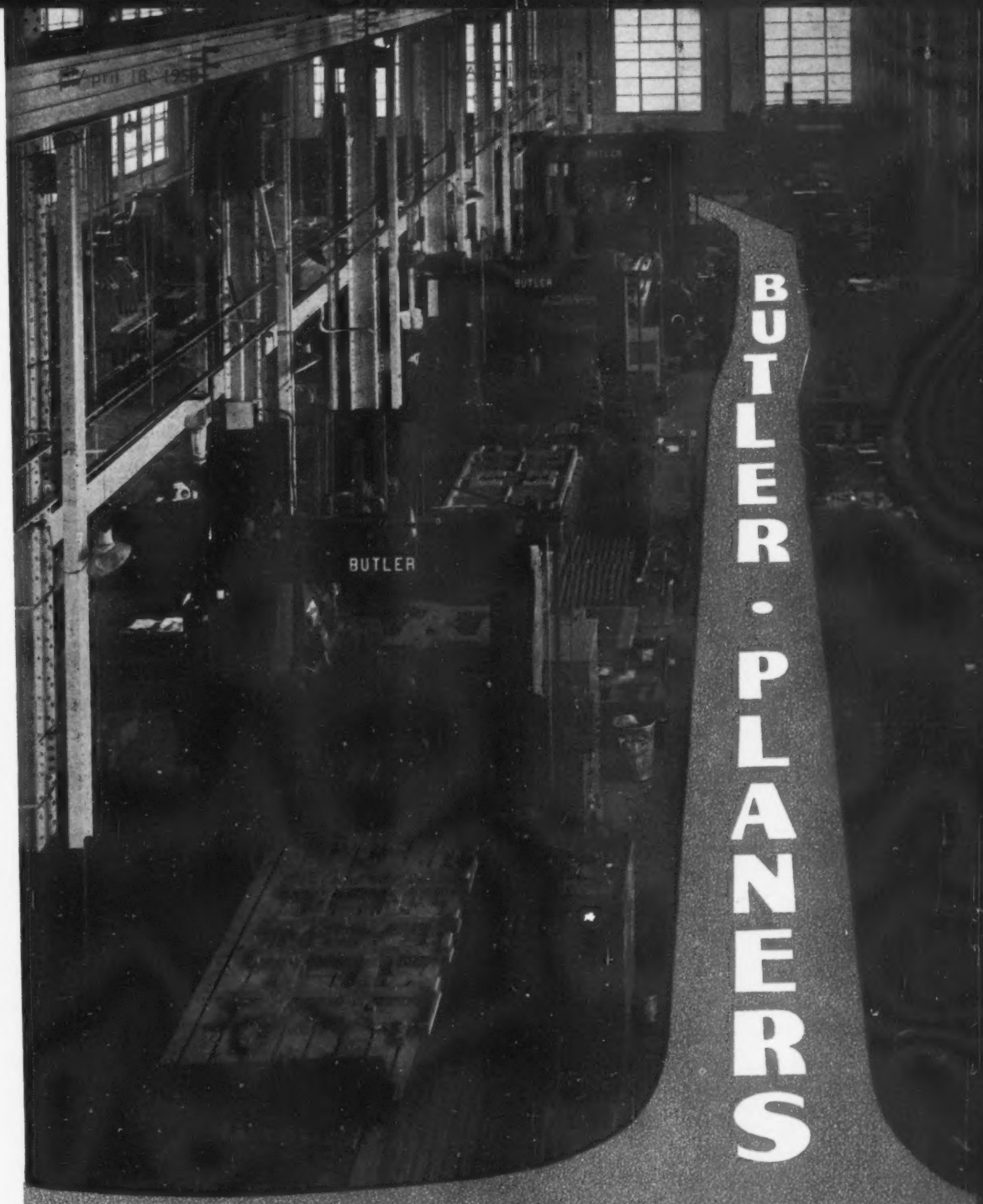

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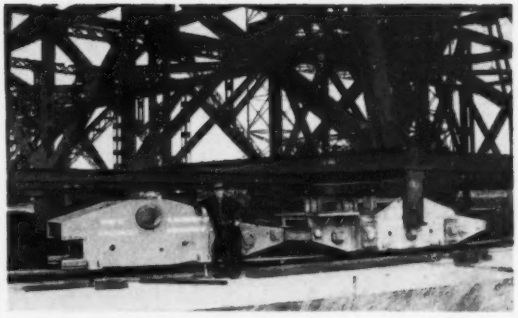
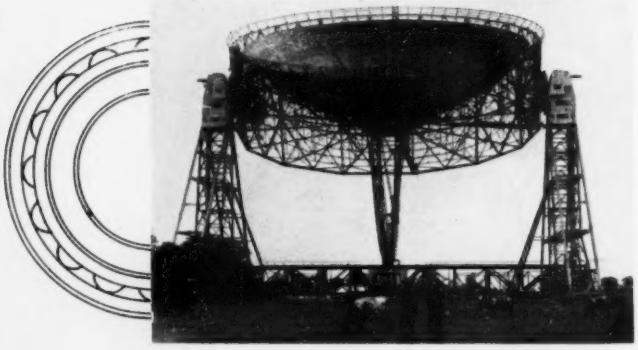


TWO OF THE TWELVE 20-TON BOGIES BY B. THORNTON LTD. ENGINEERS



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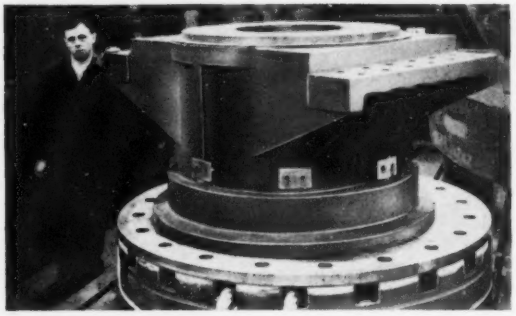

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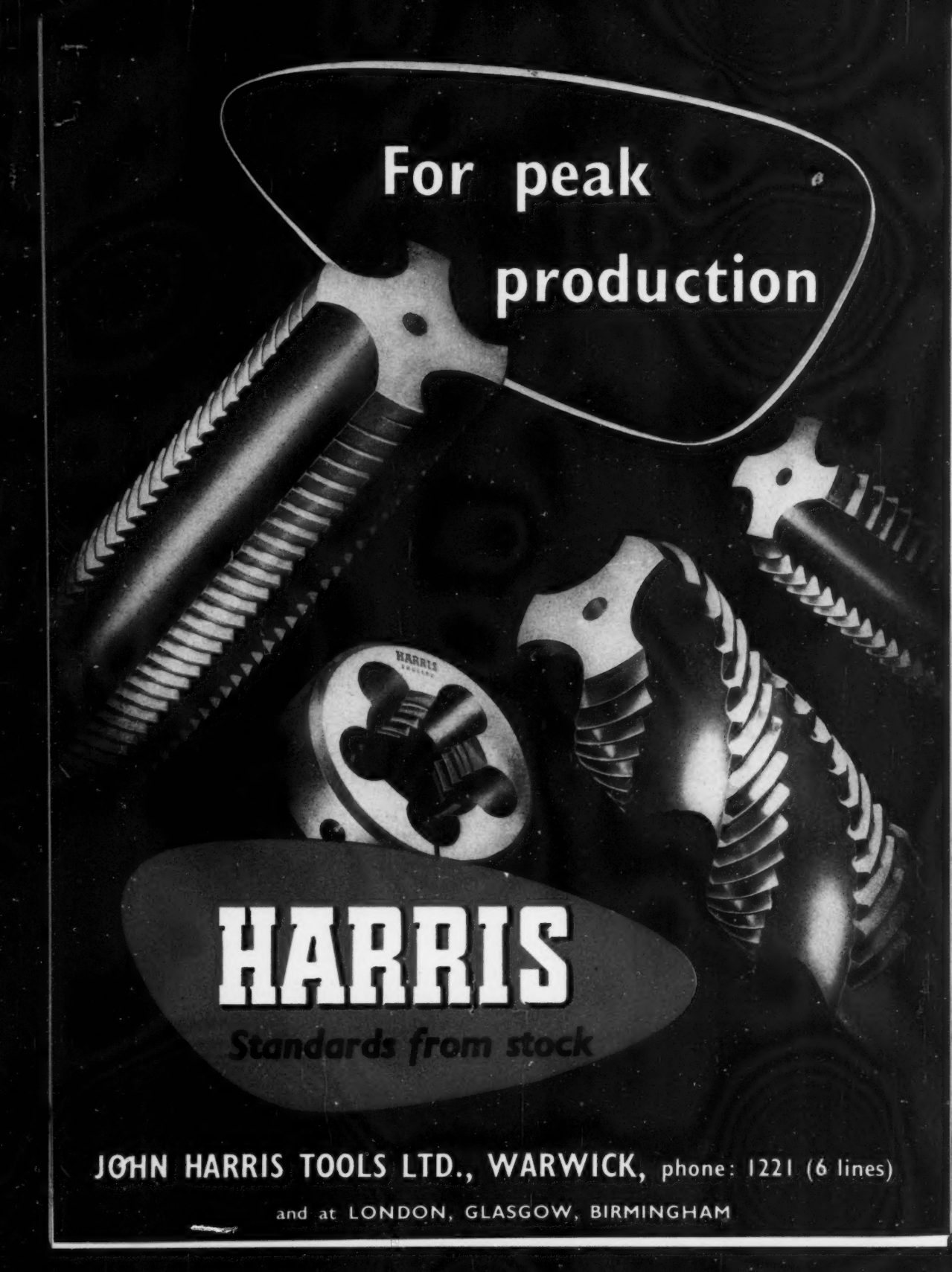

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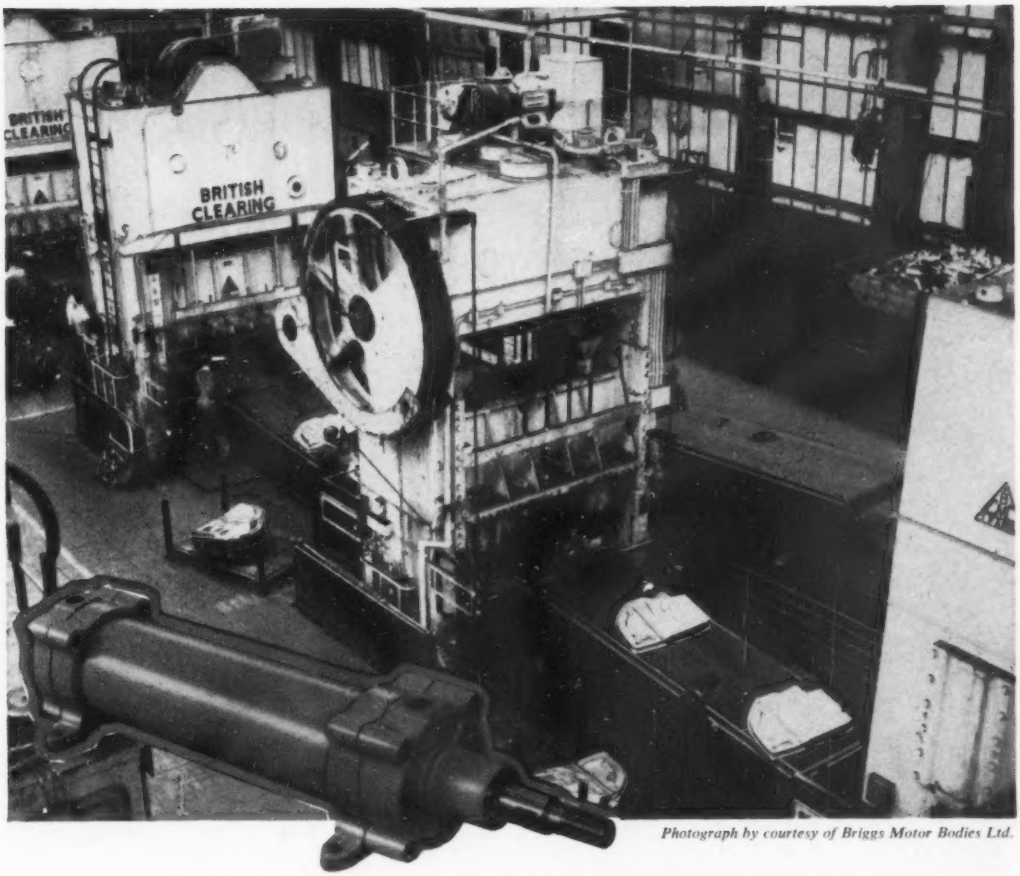

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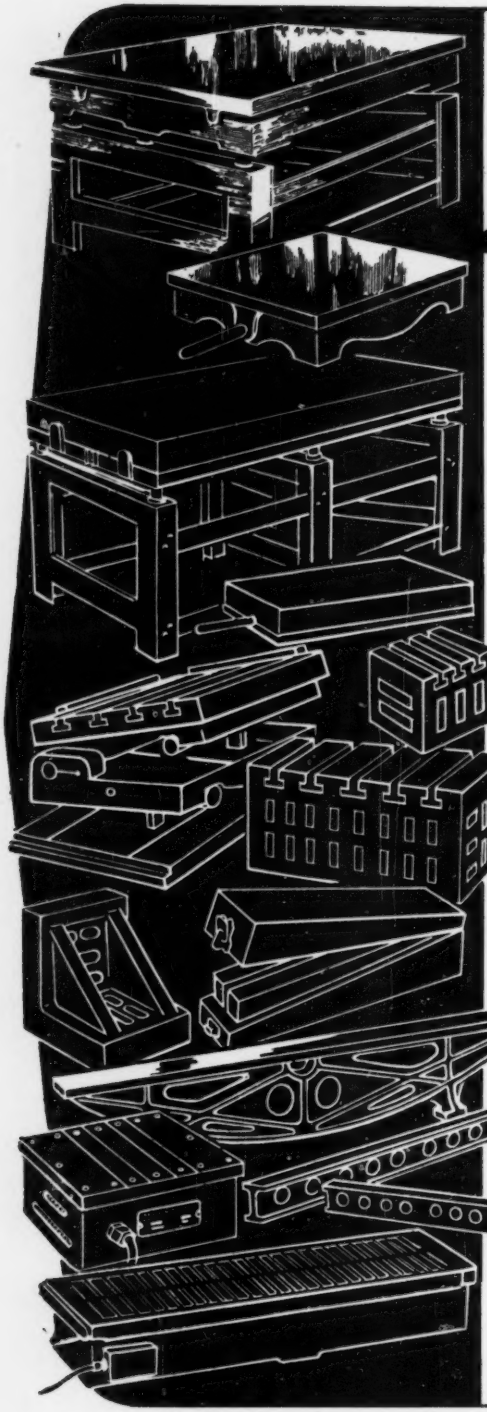

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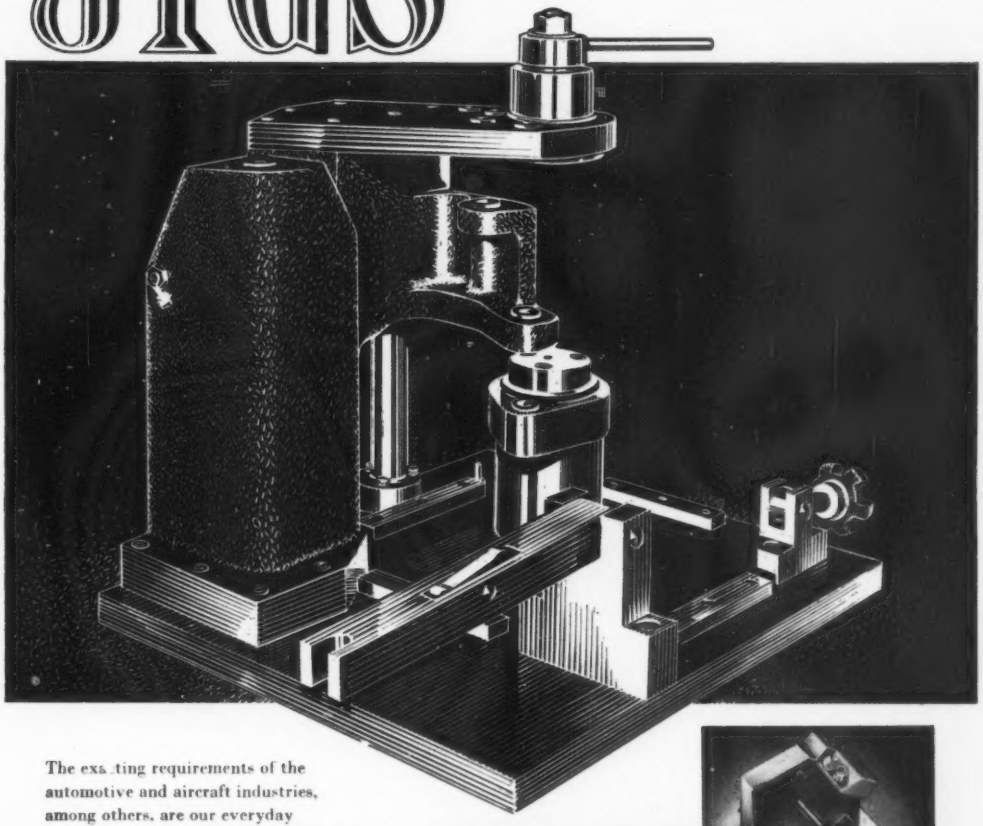

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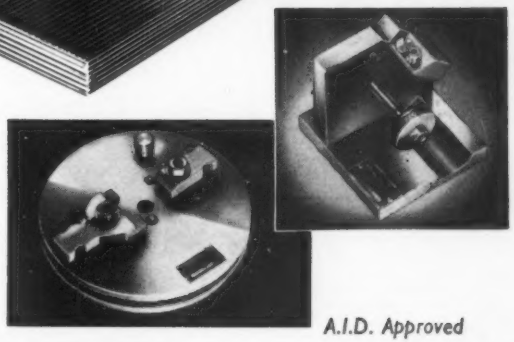

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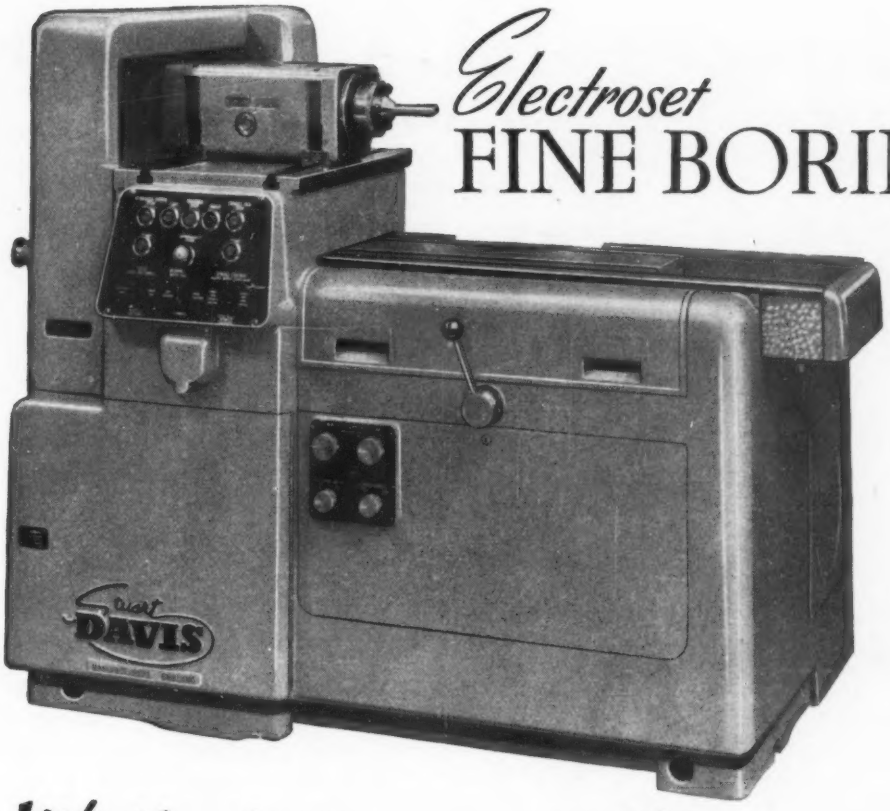

Electroset FINE BORING

'Well, what's so new in that anyway?'

. . . said one of our more cynical customers. We could only reply that it was a fact that setting up time on our machine was much less than customary, that maintenance of our hydraulic unit being completely portable was much simpler and that almost any work cycle could be obtained by the flick of a switch or turning of a valve. 'Is it competitive?' he countered, to which we modestly rejoined, 'Ask for a quotation, you will be impressed at the value for money we offer'.

It occurs to us it would be a good thing for you to find out more about our F.B.1 Fine Boring Machine and equipment.

Table travel, 15in.
Table surface Pad, 26in. by 8½in.
Height centre of spindle to table, 10in.
Table feeds, ½in. to 60in. per minute.

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Earls Court, London, 7-17 MAY, 1958

Mechanical handling is to-day's vital factor in industrial cost reduction.

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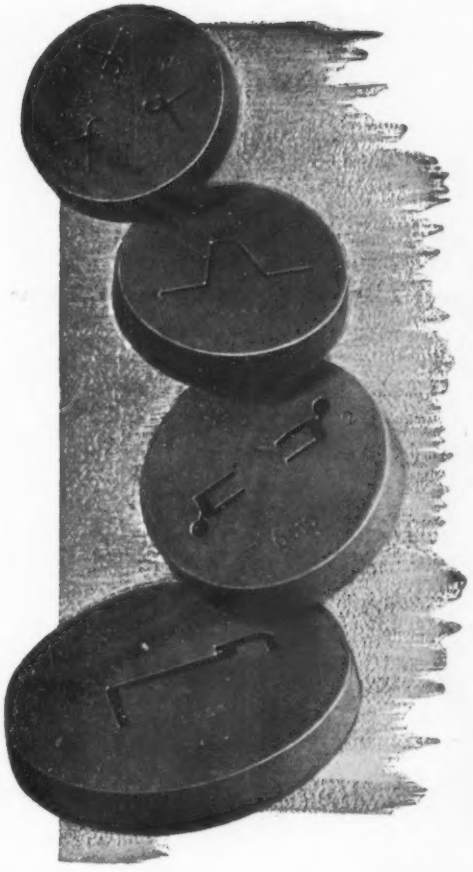
66 B

MOTOR 12S

Special Hot Die and Mandrel Steel



" Motor 12S " is suitable for many Hot Work purposes up to approximately 600/650° C.

Possesses a high degree of red hardness and may be water cooled during work.

This steel is particularly suitable for: Hot Pressing of Brass and other non-ferrous metals. Extruding ferrous and non-ferrous tubes and solids. Pressure Die-Casting of Aluminium Alloys. Drawing, Piercing, Stamping, Forging, Punching, Swaging, Heading, Shearing, Pressure Discs, Heading Tools, Pegs, Cores, Roll Dies, Chain Welding Dies, Inserts and Bolsters.

Deliveries from stocks at Sheffield and Birmingham.

We have a quality of steel for every tool steel application. Write for further details.

We can heat-treat your tools for you

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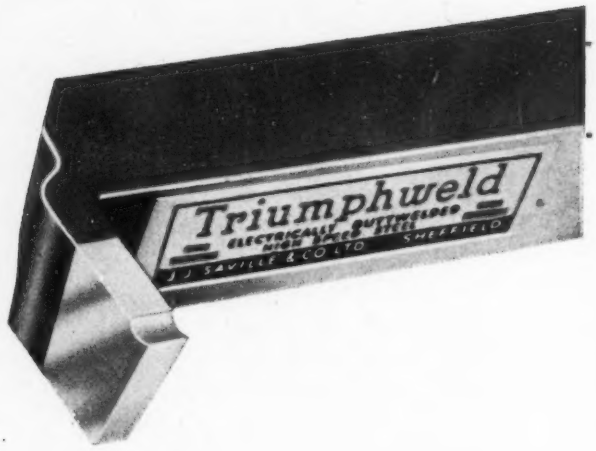
a fine cut



The gentleman in the chair relies on an expert for a fine cut. We, too, are in the chair —but as experts on fine cutting ourselves. Our butt-welded tools ensure cutting precision while permitting greatly increased operating speeds. The exceptional resistance of the High Speed cutting tip to wear and abrasion also guarantees longer service between re-grinds. A Stock List of the full Jessop-Saville range is published monthly. Please send for a copy.

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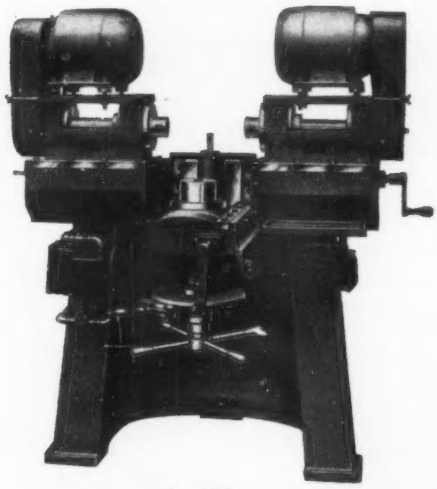

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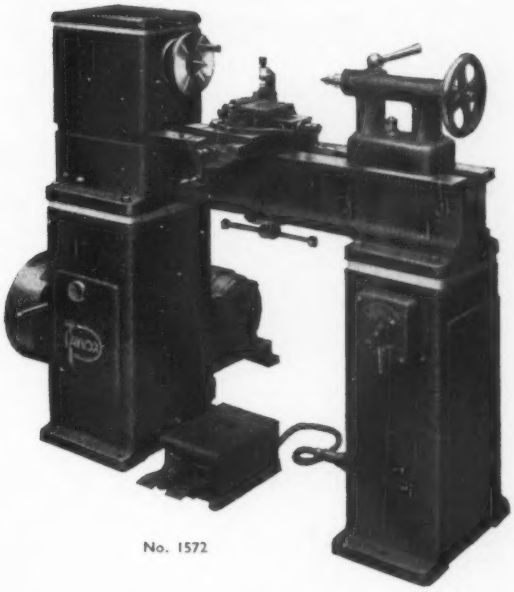

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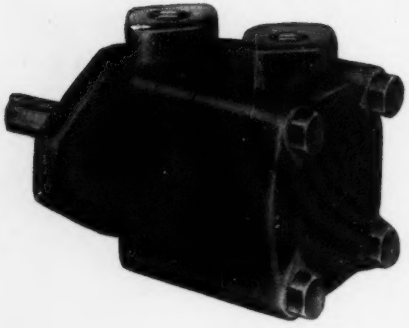

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Max. torque 290 lb.-in. at 1,000 p.s.i.

Max. speed 1,800 r.p.m.

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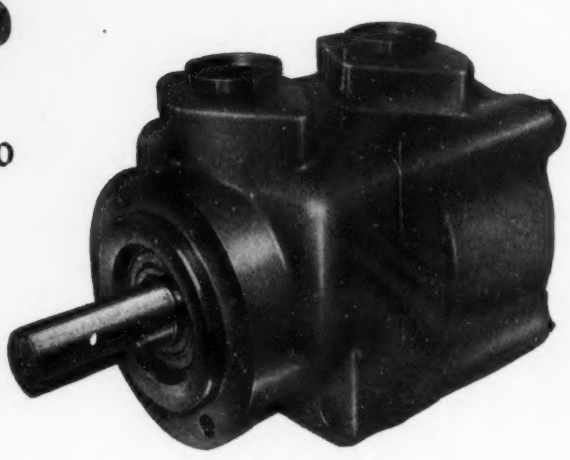

Additional advantages

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low cost and ease of maintenance.

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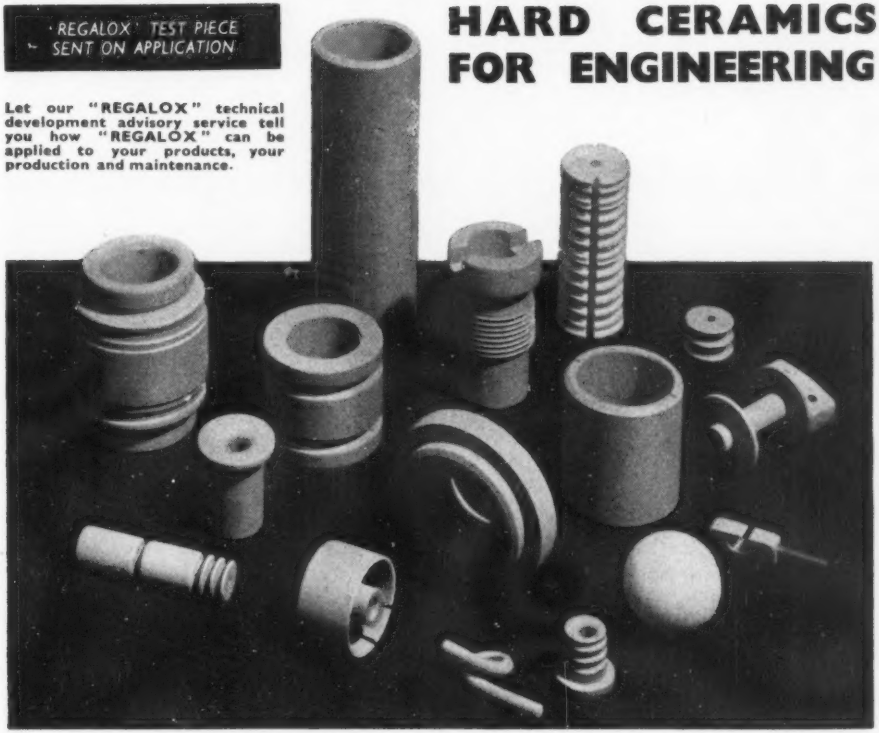
Let our "REGALOX" technical development advisory service tell you how "REGALOX" can be applied to your products, your production and maintenance.



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- **WEAR & HEAT RESISTANT**
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- **LOW CO-EFFICIENT OF FRICTION**
- **HIGH PHYSICAL PROPERTIES**

With a hardness between diamond and sapphire, highly resistant to wear and possessing excellent physical properties. "REGALOX" hard ceramics now open up new possibilities in the fields of Chemical, Electrical and Mechanical Engineering.

Unaffected by high working temperature, "REGALOX" remains dimensionally stable under all conditions. It holds close dimensional tolerances and concentricity. It is impervious to moisture and withstands the action of practically all chemicals. Where required, components can be high temperature metallised—a process which has already had a wide application in the Electronics field.

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"REGALOX" is already operating successfully in the Textile, Wire, Paint, Brickmaking, Grinding, Copper, Tin, Mechanical, Chemical, Nucleonic, and General Engineering Industries. Typical applications include:—Drill Bush Liners—Plug Gauges—Jig Bases—Textile and Wire Guides—Sand Blast Nozzles—Pump Seals and General Machine Components—Fuse Cores—Tiles—Grinding Balls—Brickmould Liners—Insulators—Bushes—Rods and Tubes.

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MOLYTONE 265 GREASE (N.L.G.I. No. 2 Grease) Penetration 265/280. Original grade, for grease-cups, ball and roller bearings (over 2" diameter, up to 2,000 r.p.m.). Temperature range, minus 20°C. to 230°C.

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The 'Bijur' system fitted to an Archdale Transfer machine at the Standard Motor Company's Banner Lane Factory.

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AUTOMATION
uses Tecalemit Lubrication

At the Standard Motor Company's Banner Lane factory in Coventry, the "Tecalemit-Bijur" Lubrication System is fitted to the three Archdale Multi-Station Transfer machines. These machines are used for machining the transmission housings for 100,000 Massey-Ferguson tractors each year.

Three "Tecalemit-Bijur" Lubricating Pumps are fitted to each machine, providing a measured quantity of oil for 170 lubrication points, at correct intervals, through calibrated metering valves. The "Tecalemit-Bijur" System, protects every bearing surface of the machine with a film of clean oil.

Tecalemit lubrication increases production time by doing away with oiling shut-downs, and by prolonging the life and precision of the machines. There's no oil wastage and maintenance costs are considerably cut.

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PERRIN MODEL AV2

JIG BORER with Optical Table

The table may be used for drilling, boring, milling and for measuring, the accuracy being controlled by a new optical system. The easily read optical image assists in rapid and positive setting, and guarantees consistent results free from errors peculiar to lead screws. A special device enables the initial point of measurements to be set at zero. Independently, two rules and pointers are provided for coarse adjustment of the table. Fine adjustment of the table is effected by means of small handwheels acting on the leadscrews through worm reduction gears. The accuracy of reading of the optical system is 0·0001in. and the limit of accuracy of setting the table over the whole range is ±0·00015in. Maximum error of glass rules ±0·00012in.

2 scales as shown controlling longitudinal and transverse settings

Swiss made—reasonably priced

SPECIFICATION

Boring capacity in cast iron 4in.
Travel of spindle $4\frac{5}{8}$in.
Infinitely variable speeds up to 3,200 r.p.m.,
three-power feeds to spindle (0·002in.,
0·004in., 0·008in.)
Table size $19\frac{5}{8}$in. by 11in.
Longitudinal movement 16in.
Transverse movement 11in.

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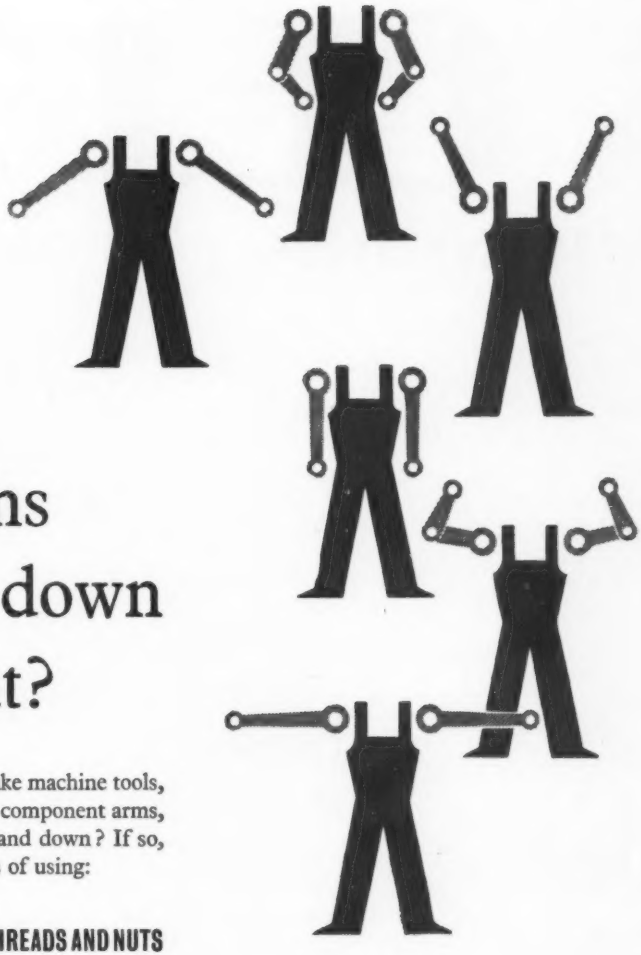

Do your arms go up and down or in and out?

We mean mechanical arms. Do you make machine tools, for example, or anything else in which component arms, shafts or rods move in and out or up and down? If so, have you considered all the advantages of using:

ROTAX RE-CIRCULATING BALL SCREW THREADS AND NUTS

Consider these unique advantages:

- 93% efficiency.
- Accuracy to .0002" per foot.
- Have a life of ten million operations.
- Available immediately in lengths up to 6 feet.
- Backed by Rotax unequalled experience in the manufacture of this equipment.

Rotax experience is at your service.

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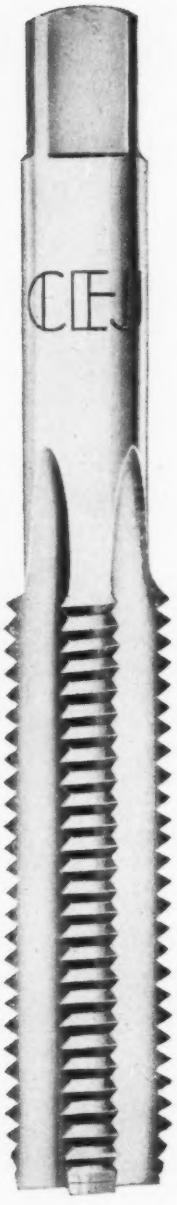
THREADING TOOLS



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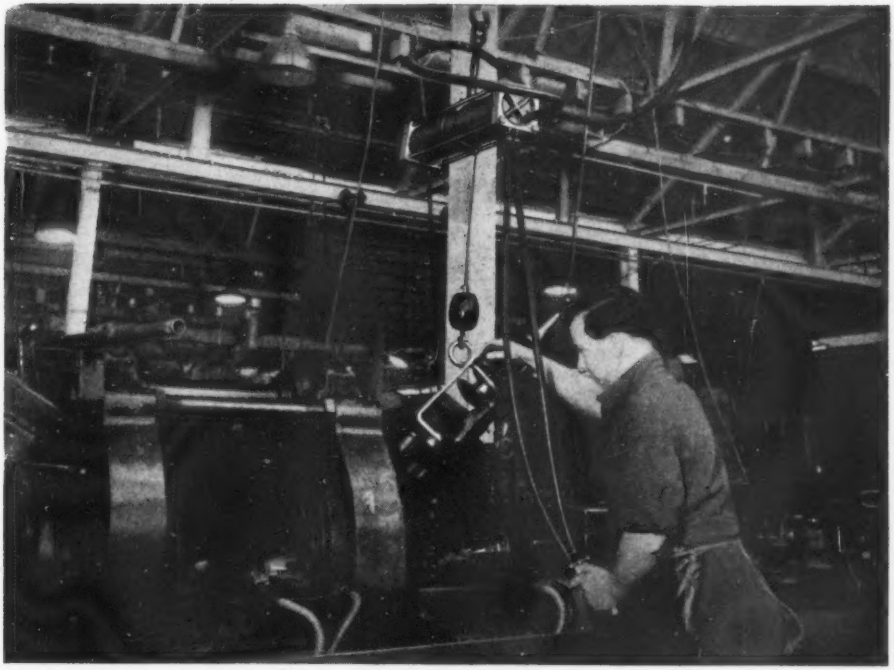

Loading a crankshaft into a Fay automatic lathe with a Martonair hoist. After approximate positioning, the work may be manoeuvred and clamped without further operation of the control valve.

Martonair HOISTS

HAVE A UNIQUE BALANCE EFFECT FOR MACHINE LOADING

The balance effect of Martonair hoists, whereby the load can be raised or lowered several inches manually without recourse to the control valve, simplifies machine loading and assists accurate alignment. Variable speed, from a creep to the maximum, ease of operation and simple maintenance make Martonair hoists indispensable in machine shops.

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Castings for James Watt

Famous names in engineering have long discussed their manufacturing problems with Carron Company. Illustrated above is a portion of the first complete set of castings for James Watt's steam engine (which made possible the development of the steam locomotive) made at Carron Company's Works in 1766 The Company have ever been eager to experiment and help in the development of new ideas.

CARRON

1958 ...*castings for the world!*

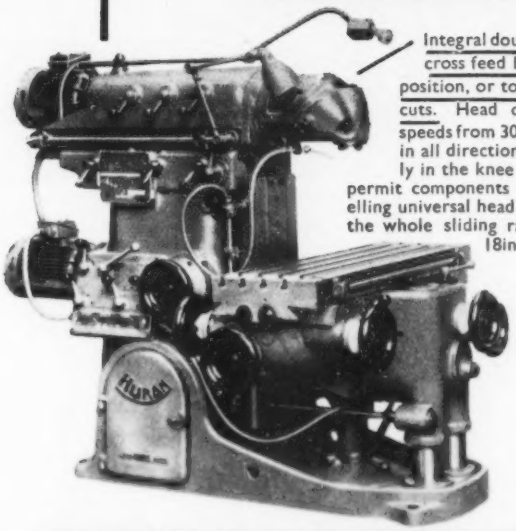
Today Carron Company covers over 200 acres. Here are

HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

HURON SUPER UNIVERSAL MILLERS

SLIDING RAM GIVES 27½in. AUTO CROSS FEED



Integral double swivelling universal head provided with 27½in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Head can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m. 27 feeds from $\frac{1}{16}$in. to 30in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14in. to enter work pieces and the whole sliding ram with its 27½in automatic cross movement needs only 18in. clearance.

Type	Table	Automatic Feeds Long	Cross	Vert.
KU4	56$\frac{5}{16}$in. × 15½in.	43½in.	27½in.	19½in.
KU5	64$\frac{7}{16}$in. × 15½in.	51½in.	27½in.	19½in.
KU6	78½in. × 16½in.	59in.	27½in.	19½in.
L7	157in. × 39in.	118in.	27½in.	39½in.

Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting.

The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table, and the sliding ram moves vertically and horizontally.

DUFOUR UNIVERSAL MILLERS

Table surface 43$\frac{5}{16}$in. by 9½in. or 47½in. by 10½in. Auto long. feed, 26½in. or 30½in. Auto vert. feed, 15½in. or 18½in. Auto cross feed 9½. Rapid traverse in all directions. No. 40 International taper for main spindle, universal head, and rotary table. Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Spindle speeds 21 to 1,600 r.p.m. Twin overarms. Separate motor for rapid traverses.

Dufour No. 54 Universal Miller. Table surface 62.99in. by 14.763in. Automatic long. feed: 39.37in.; vert. 20.275in.; cross: 14.173in. and automatic cross feed of universal head 25½in. Manual vert. feed: 4½in. 18 spindle speeds for universal head: 12 to 1,500 r.p.m. 36 spindle speeds for horizontal spindle 6 to 1,500 r.p.m. Can also be supplied as plain miller, with central detachable universal head, or with side universal head, without automatic feed.

PERRIN MODEL AV2

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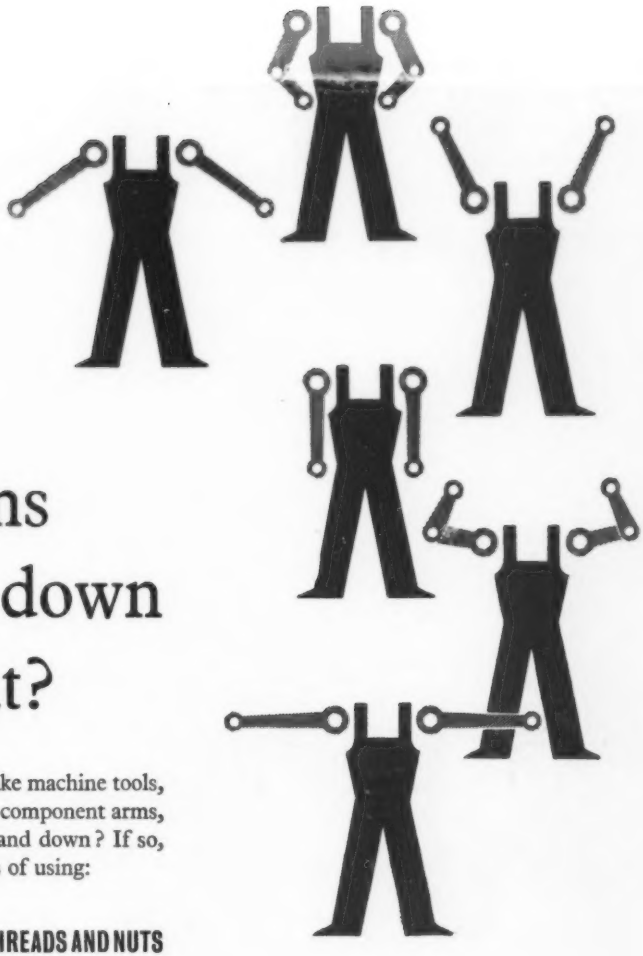

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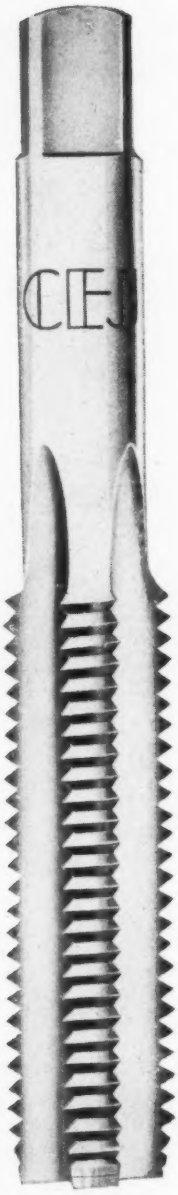

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Chaser Dies
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Round Dies
Thread Milling Hobs
Thread Rolling Dies
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Mikrokators
Micro Snap Gauges
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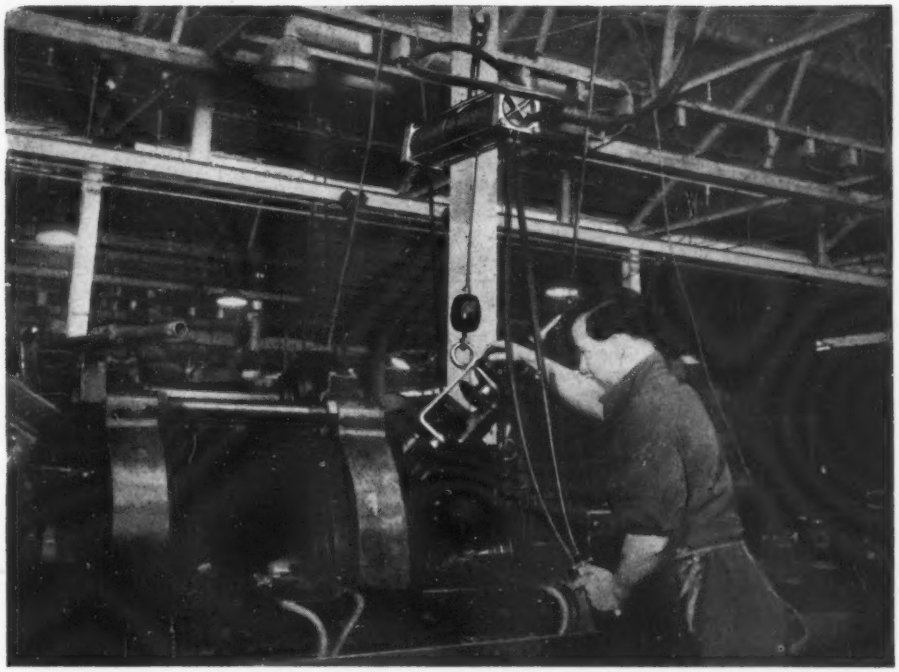

Loading a crankshaft into a Fay automatic lathe with a Martonair hoist. After approximate positioning, the work may be manoeuvred and clamped without further operation of the control valve.

Martonair HOISTS

HAVE A UNIQUE BALANCE EFFECT FOR MACHINE LOADING

The balance effect of Martonair hoists, whereby the load can be raised or lowered several inches manually without recourse to the control valve, simplifies machine loading and assists accurate alignment. Variable speed, from a creep to the maximum, ease of operation and simple maintenance make Martonair hoists indispensable in machine shops.

FULL DETAILS ON REQUEST FROM:
MARTONAIR LIMITED, PARKSHOT, RICHMOND, SURREY, ENGLAND. Tel: RICHMOND 2201 (6 lines).

AD

Castings for James Watt

Famous names in engineering have long discussed their manufacturing problems with Carron Company. Illustrated above is a portion of the first complete set of castings for James Watt's steam engine (which made possible the development of the steam locomotive) made at Carron Company's Works in 1766 The Company have ever been eager to experiment and help in the development of new ideas.

CARRON

1958 ...castings for the world!

To-day, Carron Company covers over 200 acres. Here are light and heavy foundries, forging shops, machine shops, fabrication shops and enamelling plant. As alert to new trends and techniques in this year as they were almost 200 years ago, Carron Company has a reputation for quality which the most astute manufacturer accepts without question. Consultations are welcome any time.

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Showrooms and Sub-offices : 15 Upper Thames Street, London, E.C.4. 22-26 Redcross Street, Liverpool, 1
125 Buchanan Street, Glasgow, C.1. Sub-Office : 33 Bath Lane, Newcastle upon Tyne.

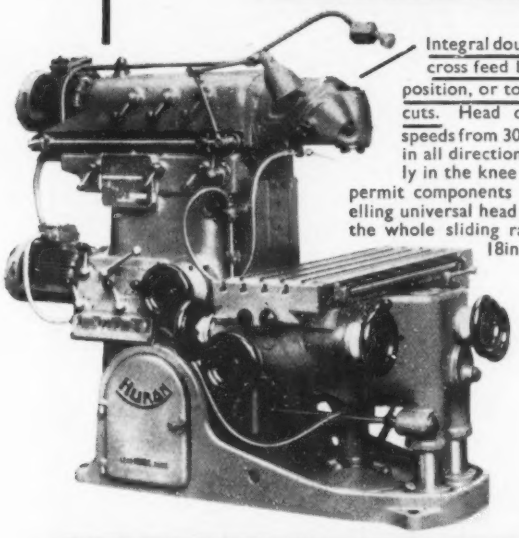
44A

HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

HURON SUPER UNIVERSAL MILLERS

SLIDING RAM GIVES 27½in. AUTO CROSS FEED



Integral double swivelling universal head provided with 27½in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Head can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m. 27 feeds from $\frac{1}{16}$in. to 30in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14in. to enter work pieces and the whole sliding ram with its 27½in automatic cross movement needs only 18in. clearance.

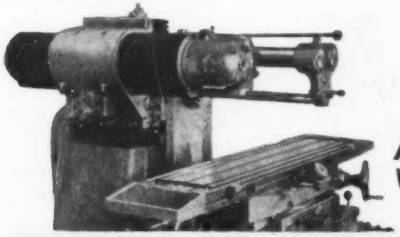
Type	Table	Automatic Feeds Long	Cross	Vert.
KU4	56$\frac{5}{16}$in. × 15½in.	43½in.	27½in.	19⅝in.
KU5	64$\frac{5}{16}$in. × 15½in.	51½in.	27½in.	19⅝in.
KU6	78½in. × 16½in.	59in.	27½in.	19⅝in.
L7	157in. × 39in.	118in.	27½in.	39⅜in.

Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting.
The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table, and the sliding ram moves vertically and horizontally.

DUFOUR UNIVERSAL MILLERS

Table surface 43$\frac{5}{16}$in. by 9⅞in. or 47½in. by 10⅞in. Auto long. feed, 26½in. or 30½in. Auto vert. feed, 15⅝in. or 18⅞in. Auto cross feed 9½. Rapid traverse in all directions. No. 40 International taper for main spindle, universal head, and rotary table. Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Spindle speeds 21 to 1,600 r.p.m. Twin overarms. Separate motor for rapid traverses.

Dufour No. 54 Universal Miller. Table surface 62.99in. by 14.763in. Automatic long. feed: 39.37in.; vert. 20.275in.; cross: 14.173in. and automatic cross feed of universal head 25½in. Manual vert. feed: 4½in. 18 spindle speeds for universal head: 12 to 1,500 r.p.m. 36 spindle speeds for horizontal spindle 6 to 1,500 r.p.m. Can also be supplied as plain miller, with central detachable universal head, or with side universal head, without automatic feed.



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We supply* EX-STOCK *and demonstrate* CLARE *Chucks and Collets

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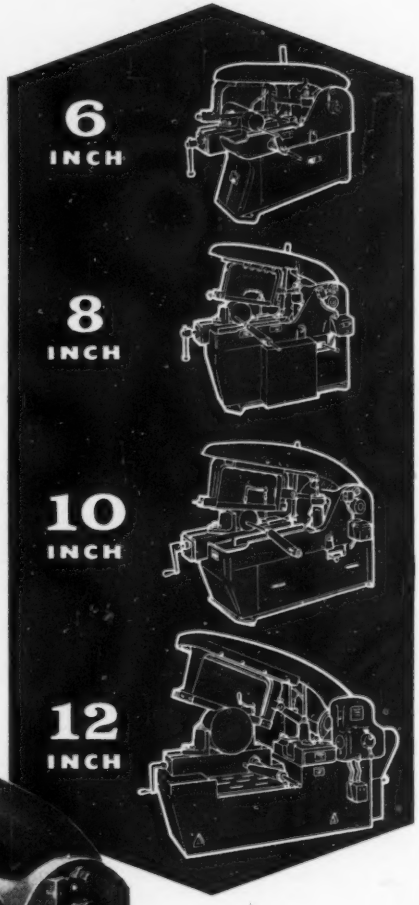

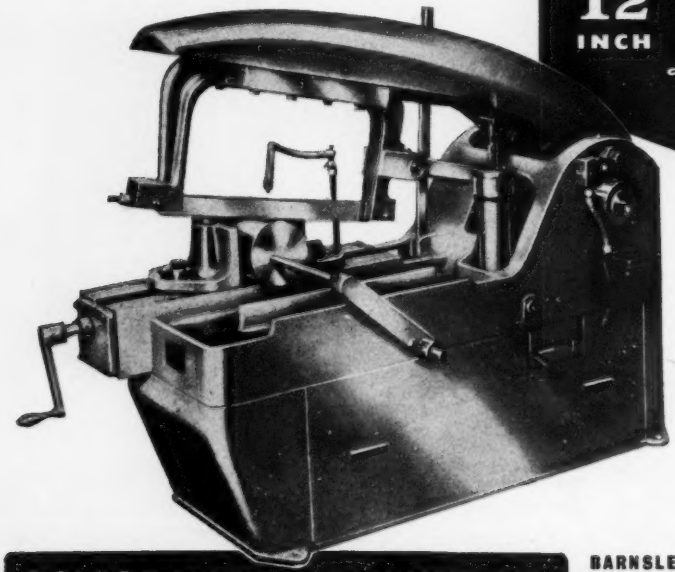

Illustrated: 10 inch "Sawmaster"

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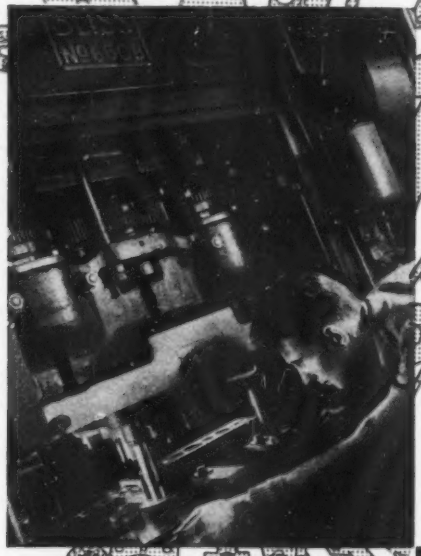

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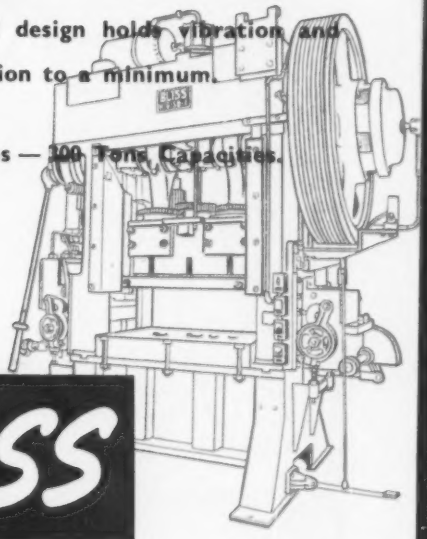

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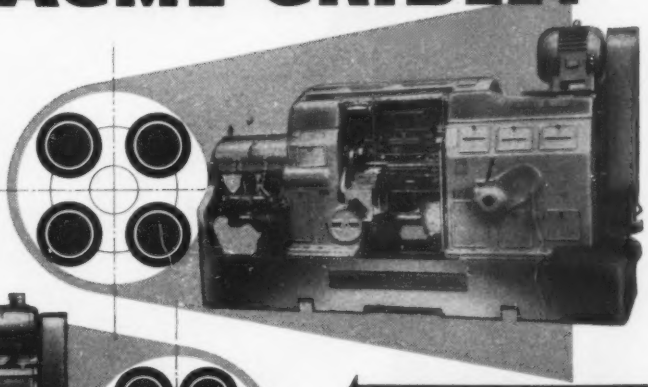
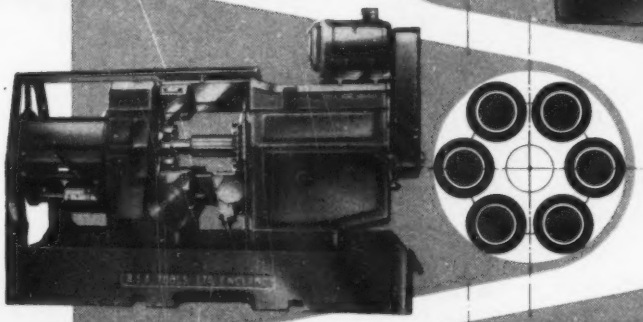
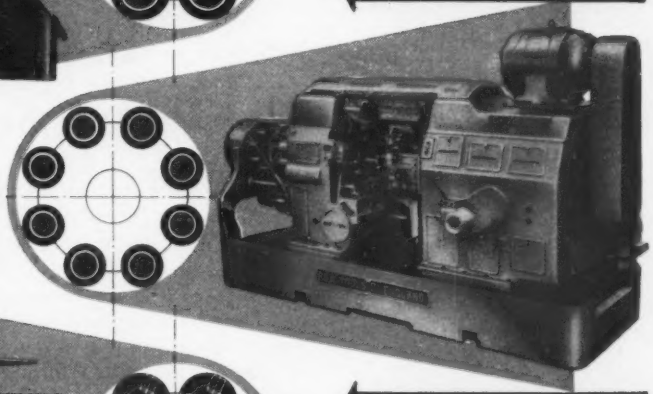
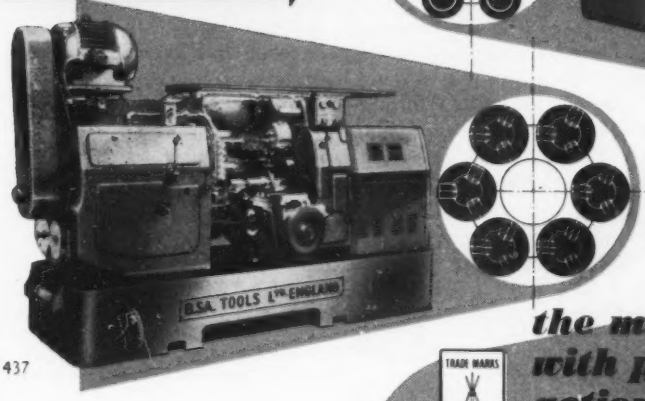




BAR
7/16", 1", 1¼", 1⅝", 2⅝"
SIX SPINDLE

BAR
1⅝"
EIGHT SPINDLE





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6"
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437

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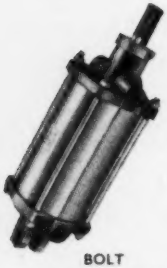

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AIR CYLINDERS

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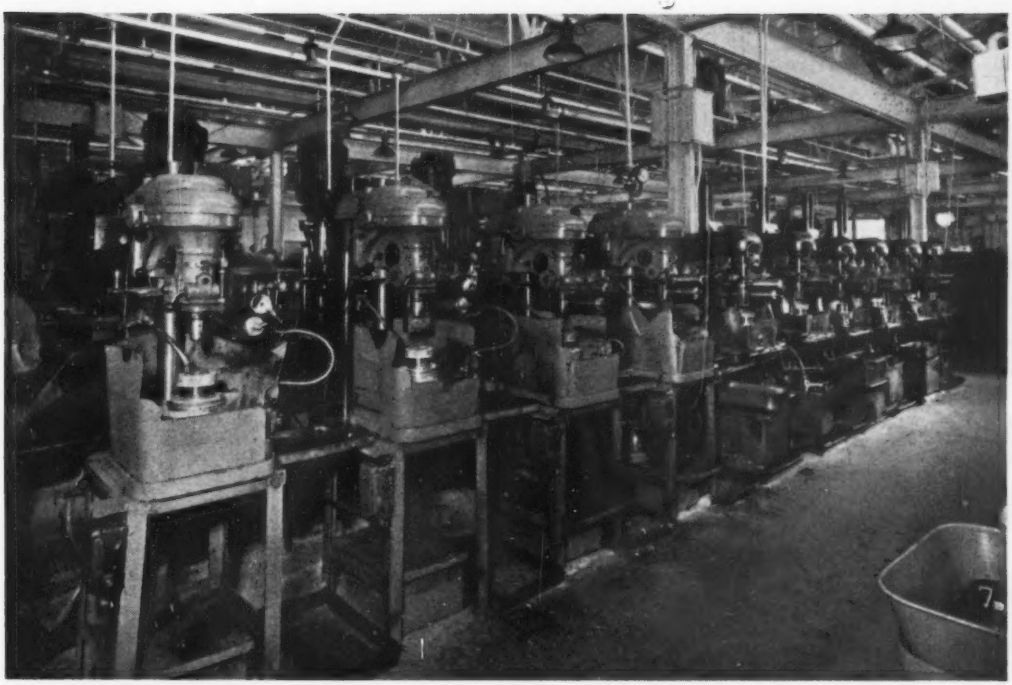

Three men . . . do the work of ten

This installation of Pacera automatic power-feed machines paid for itself within less than a year. Three men now handle the ten machines, where ten men were formerly needed.

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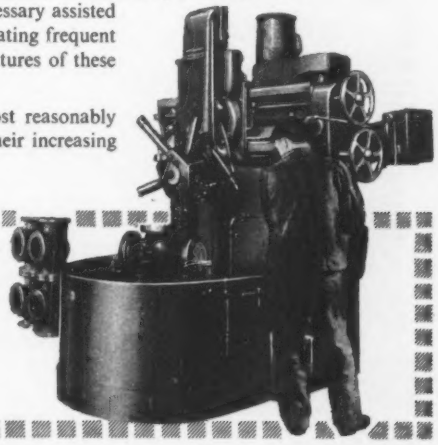

The illustration shows one of the battery of Webster and Bennett Boring Mills installed in the London Works of Dewrance & Co. Ltd., facing, turning, boring and screwing 5" valve bodies in a floor to floor time of 66 minutes.

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With oil-hydraulic table operation.
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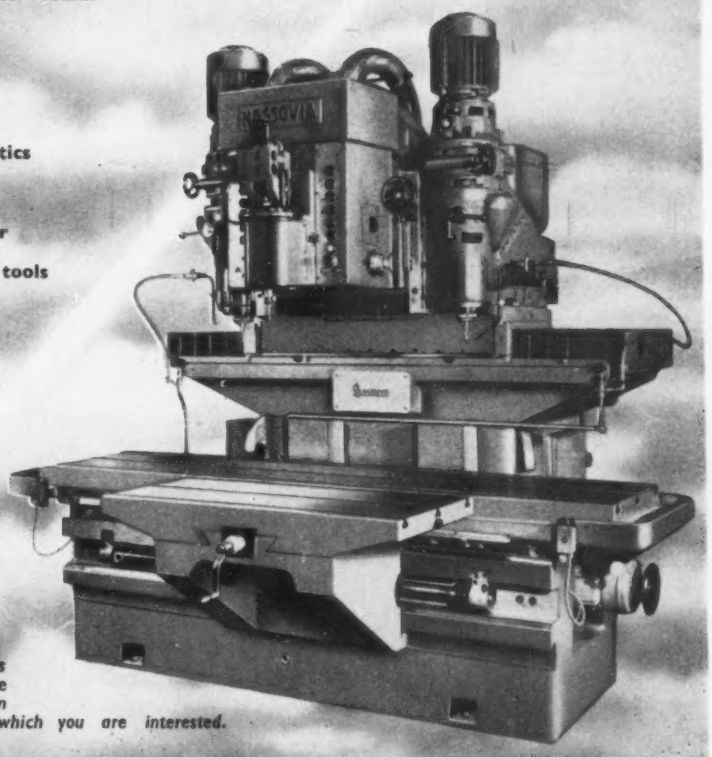

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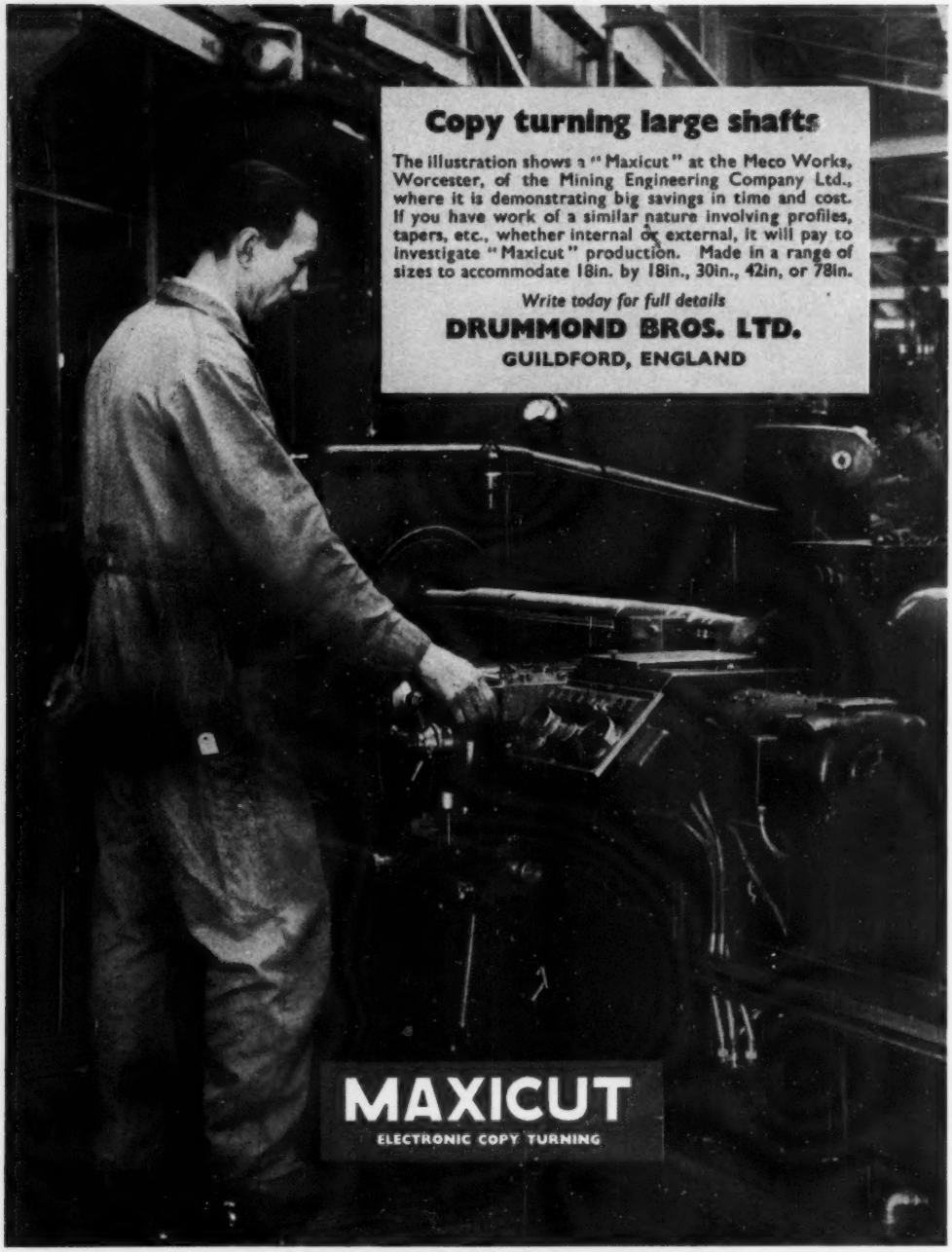
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Abstracts of Principal Articles

Jameson Universal Production Aerofoil Generating Machine ..... P. 876

The machine described in this article has been designed and built for the production generation of concave or convex aerofoil-section wing panels. Basically, the method employed is single-point planing, with a stationary workpiece and a reciprocating tool-box, the latter being traversed in a floating tool-slide. Templates, which represent the projected tip- and root-sections of the finished wing-panel, are held in adjustable carriers fixed at the extremes of the workpiece. The tool-slide is carried in a 28-ton swivelling-beam, which is pivoted, at its centre, on a 15-in. diameter roller bearing, and this beam is adjusted vertically, and angularly, at the end of each cutting stroke. Details are given of the means employed for automatically positioning this beam and of the epicyclic drive to the tool-box, which provides a range of traverse speeds varying from 2½ in. per min. to 300 ft. per min. A cut is taken in each direction of tool-box traverse, and a description is given of the pivoting tool-holder employed for this purpose. The worktable, which measures 25 ft. by 8 ft., can be swung from the vertical (working) position to the horizontal, in order to facilitate loading, and details are given of the trunnion-mounting and drive arrangements for this movement. (MACHINERY, 92—18/4/58.)

Production of Distribution Transformers P. 888

To provide increased facilities for the production of distributor transformers up to 1,500 kVA, 33 kV, Ferranti, Ltd., in 1956, took over extensive factory premises in West Gorton, Manchester, where production is now concentrated on an efficient flow-line basis. Roller conveyor systems are provided in the tank fabricating, assembly, test, and despatch sections, and the new layout has enabled the time cycle from the issue of raw material to the completion of an order to be reduced by 20 per cent. The policy of rationalizing design, which has been pursued progressively by the company, now permits 60 per cent of the transformers to be built as substantially standardized types. Reference is also made to the production of Ferranti lock wound cores, which have been specially developed to provide increased efficiency in small single-phase distribution transformers. (MACHINERY, 92—18/4/58.)

High-speed Cutting of Drawn and Extruded Sections ..... P. 898

At the Trafford Park works of Metropolitan-Vickers Electrical Co., Ltd., drawn and extruded sections of brass, copper, and light alloy, are rapidly cut into lengths on a Rowland-type AHC cutting-off machine, which has been adapted by fitting a Firth-Brown Mitia tungsten carbide-tipped saw in place of an abrasive wheel. The bar is fed by hand to an adjustable end-stop, which is automatically retracted after the material has been gripped in the hydraulic vice, and before the cut is started. Saws of special tooth form are employed at a speed of 7,000 ft. per min., and the feed rates for brass range up to 80 in. per min., depending on the section. Cuts are parallel within 0·001 in., and a length tolerance of 0·005 in. is normally maintained. (MACHINERY, 92—18/4/58.)

Some Equipment Employed for Machining Dynaflow Transmission Components P. 902

Typical operations performed on components for the Buick Flight Pitch Dynaflow transmission are described in this article. Holes for variable-pitch stator vane shafts are drilled on the joint line between the front and rear cast-iron carriers, with Bor-Dril tools, on a machine with four horizontal, radial heads. There are 20 holes, and the work is indexed four times to complete the cycle. Discs and hubs for the first turbine converter are mechanically assembled and welded on a 10-station transfer machine. Other operations discussed are concerned with the flame-hardening of bearing surfaces on races for free-wheel units, and the superfinishing of surfaces of disc-and-hub assemblies. (MACHINERY, 92—18/4/58.)

Turret Type Carrier for Rapid Broach Changing ..... P. 913

At Watervleit Arsenal, U.S.A., broaching has been effectively employed for machining the openings in breech rings for 90-mm. guns. Because numerous, heavy broaches are required, handling of both broaches and work originally presented a problem. For this reason, two special broaching machines have now been installed, each of which is equipped with two work-holding fixtures, and an 8-station horizontal turret for the broaches. With this arrangement, the broaches are indexed successively to the operating position, and the fixtures are shuttled to and fro, in the horizontal direction, to bring the workpieces to the broaching station, and to provide for the return of the broaches. (MACHINERY, 92—18/4/58.)

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IN FORTHCOMING ISSUES

Fairey 3-dimensional contour milling machine with Ferranti magnetic tape control system—Producing the Vauxhall Victor—The dimensioning and quality control of involute splines.

The Economic Survey

The Economic Survey for 1958* indicates that 1957 was a year of moderate expansion, with total expenditure, in real terms (and at 1956 factor cost), higher by £435 million than in 1956, which represented an increase of 2 per cent. As compared with the previous year there was a rise of £150 million in gross fixed investment, and of £165 million in the amount invested in stocks and work in progress. The total for fixed investment (at 1948 prices) was £2,323 million, of which £840 million was invested in plant and machinery.

Manufacturing industry accounted for £632 million of the fixed investment total, and this sum represented an increase of only 3 per cent as compared with the figure for 1956, which was 12 per cent higher than that for 1955. This reduction in the rate of increase can only be regarded as unwelcome in view of the age and condition of so much of the plant that is still in use, and the continued urgent need for its replacement. More serious, however, is the fact that investment in the engineering and allied industries, which play so increasingly important a part in the economy of the country, actually showed a decrease last year in comparison with 1956. In this connection, it should be pointed out that this decrease covered fixed investment as a whole, and there is no breakdown to show how plant and machinery on the one hand, and "buildings" on the other, were affected.

For many companies, investment in stocks and work-in-progress presents an increasing problem. It is stated that manufacturers' stocks, which represent about half the national total, were 6 per cent higher in volume, and 8 per cent higher in value, at the end of 1957 as compared with the end of 1956. During the past 10 years, the growth of stocks in manufacturing industry has at least kept pace with the increase in production, and "within the total of these stocks there has been an increase in relation to output in the holdings of finished products and work-in-progress."

Industrial production, which accounts for about one-half of the gross domestic product, was about 1½ per cent higher, on average, in 1957 than in 1956. During the early months of last year production hardly rose at all, but there was some increase in the second quarter, and the improvement was then maintained. As between 1956 and 1957, it is reported, the rise in output came mainly from the engineering and allied industries. This rise, however, represented no more than a partial recovery from the fall in the previous year, and for 1957 as a whole the output of these industries was still somewhat lower than in 1955.

Even if the amount of investment in recent years has been inadequate, it has none the less been substantial, and the results indicated can only be regarded as disappointing. In the circumstances, it is evident that greater efforts are needed, on the part of all concerned, to ensure better utilization of available plant, so that higher standards of efficiency and productivity can be achieved. In this connection it may also be noted that the output per man-year for industry as a whole only increased from 120 in 1954 (1948=100) to 124 in 1957.

Exports last year also failed to maintain the rate of progress achieved in 1955 and 1956. The total value for 1957, as shown in the trade accounts, was £3,325 million, of which metals and engineering products accounted for £1,832 million. For 1956 the total was £3,172 million (£1,711 million), for 1955, £2,905 million (£1,514 million), and for 1954, £2,674 million (£1,353 million). Although there was an appreciable rise in the value of exports, it is stated that for merchandise there was no increase, in real terms, as compared with 1956. It is satisfactory to note that whereas export prices were 4½ per cent higher, on average in 1957 than in 1956, the upward movement, which had continued since early in 1955, was arrested in the fourth quarter. In January of this year, indeed, the index was slightly lower than for the second half of 1957. These remarks do not apply, however, to metals and engineering products, for which the index figures continued to rise throughout last year.

In the concluding chapter of the survey it is suggested that the pressure of demand on productive resources, which has been gradually easing for the past two years, is not likely to show any immediate increase. It is considered that private fixed investment will rise less than in earlier years and that investment in stocks will probably need fewer resources than in 1957. Attention is also drawn to the opportunity which is presented for arresting the rise in prices of goods both for the home market and for export, following an 8 per

(*Continued on page* 926)

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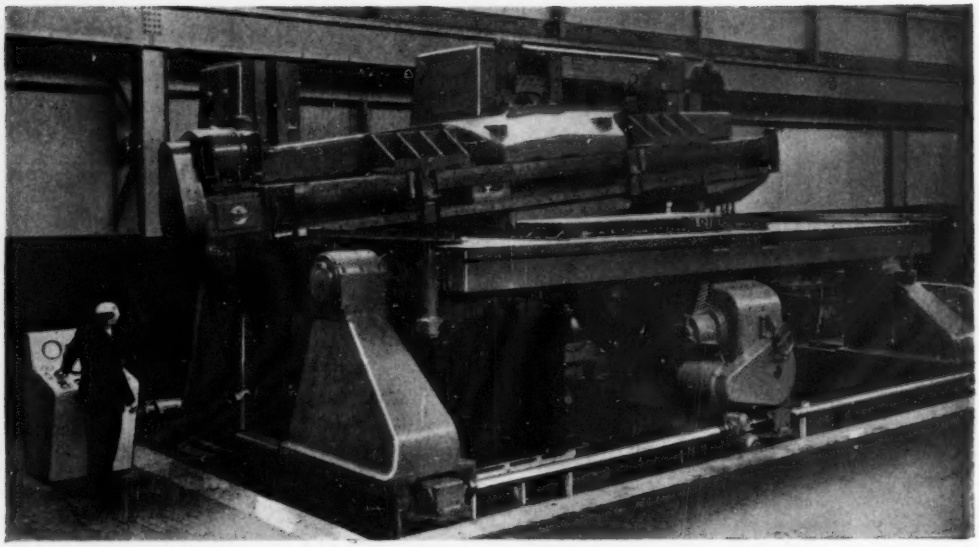


Jameson Universal Production Aerofoil Generating Machine

Mention has already been made in MACHINERY (92/43—3/1/58), of a large production aerofoil generating machine which has been designed and built by J. L. Jameson, Ltd., Ewell, Surrey. This machine, which has been ordered by the Air Division, Ministry of Supply, as part of the production development programme of machine tools to deal with large stretch-stabilized, light-alloy slab components, has recently been carrying out its acceptance trials. The machine, which has a total weight of approximately 170 tons is shown in the heading illustration installed in the Jameson No. 2 Heavy Division works at Chessington, Surrey.

Basically, the method of wing-generation on this machine is by single-point planing, with a stationary workpiece and a reciprocating tool-box, a cut being taken in each direction of traverse. The tool-box reciprocates in a fully-floating tool-slide which, in turn, is carried in a swivelling-beam. At the ends of the tool-slide there are knife-edges, which are brought into contact, hydraulically, with templates fixed on the work-table at the extremities of the workpiece. These templates represent the projected tip- and root-sections of the finished wing, and the tool follows a straight path between the two templates. After each pass of the tool-box, the tool-slide and knife-edges are relieved from the templates, and the swivelling-beam is moved automatically, vertically and angularly, in preparation for a fresh cut in the opposite direction. These movements continue, in sequence, until the entire wing surface has been machined, when the depth of cut for a second planing operation is set by adjusting the position of the templates relative to the machined surface of the workpiece.

This method of straight-line planing generation of aerofoil sections, both concave and convex, is substantially the same as that employed by the company for machining the dies used on their abrasive-band profiling machines, for producing turbine and compressor blades, and is covered by a British Patent.

Designed for the production generating of wing planks up to 24 ft. long by 8 ft. wide, the machine can also be arranged for milling. An attachment can be fitted which permits of milling the flanks of chord-wise ribs on the underside of a wing, and "run-out" pockets, adjacent to these ribs, for subsequent span-wise planing. By means of this attachment, the machine is enabled to perform operations on both top and bottom surfaces of a

wing plank, as may be required in the case of prototypes, or where a master is required for copying purposes on simpler machines. Ribs generated with this milling head, to the same setting, form an exact match with their wing attachments.

As an indication of the capabilities of this machine, the following figures are quoted by the builder. When planing light-alloy DTD.646, a tool-traverse speed of 300 ft. per min., a depth of cut of 0·50 in., and a feed increment of 0·04 in. may be employed, which represents a metal removal rate of 72 cu. in. per min. Allowing for the dwell period at the end of each cutting stroke, during which the tool-slide is relieved and the swivelling-beam is adjusted vertically and angularly, also for the time required to accelerate the tool-box, an average rate of metal removal of 40 cu. in. per min. can be maintained.

In order to erect the aerofoil generating machine, it was necessary to provide a pit in the shop floor measuring 22 ft. wide by 34 ft. long by approximately 4 ft. deep. Portions of this pit are 5 ft. deep, in order to give access to the levelling and bolting-down arrangements for the floor-plates, and there are two 30-in. square by 7-ft. deep pits, which house the hydraulically-operated rams used for balancing the 28-ton swivelling-beam. A rigid foundation was required in order to support such a heavy machine, and the average depth of concrete provided was 3 ft.

The bed of the machine is made-up of five separate sections, each 2 ft. 6 in. deep, tenoned and bolted together and arranged in an E-formation, the long side of which serves to support the three vertical columns. On each of the legs of the E-form there is a sub-bed, with 7-in. wide, flat, guideways, which carry the traversing trunnion mountings for supporting the worktable.

For convenience of description, the machine may be considered in two separate parts, and referring to Fig. 2, which is an end elevation, the division referred to above is on a vertical plane approximately through the centre of the drawing. The part of the machine to the right is referred to as the worktable portion, that to the left as the swivelling-beam and tool-slide, and the machine will be described in that order.

PIVOTING WORKTABLE

The worktable, which weighs 20 tons, is made in two sections, joined at the centre, and has a T-slotted working surface measuring 25 ft. 6 in. by 8 ft. In order that the workpiece may be loaded and positioned more easily, the table is arranged to swivel through 90 deg. into the horizontal plane, and is therefore supported on three trunnions, which enter bearings in housings at *A*, *B*, and *C*, Fig. 1. Each trunnion is of cast iron, and the 14-in. diameter plain, pivot bearings are also of cast iron, and provided with half-caps. The table is swivelled by two 16-tooth, 2-D.P., 20-deg. single-helical pinions which mesh with the segments, *D*, Fig. 1 and 2, attached to the underside of the table. These segments are of En. 14B welded steel construction, and, as can be seen in Fig. 2, are less than a complete semi-circle. The segments were fabricated separately, and then are bolted together for the finish-turning operation, spacers of suitable thickness being inserted in order to produce a complete circle. As can be seen in Fig. 1, the segments straddle the centre trunnion mounting, *B*, and the close-up view, Fig. 3, shows the two gear segments and the drive arrangements for pivoting the table. A 15-h.p. constant-speed motor is employed, and the drive is transmitted through V-belts to a 17-in. centre, worm and wheel, housed within the main casting *B*. The ratio of this worm and wheel is 70:1, and the 16-tooth pinions already mentioned are mounted on the ends of the worm-wheel shaft. After the workpiece has been loaded, the table is swung to the vertical position, and the time required for this 90-deg. angular movement is 35 sec. In the vertical position, clamps are applied to the centre web of each segment, to lock the worktable during the entire machining cycle. At *E* in Fig. 3 can be seen one of a pair of trip-dogs, which operate a switch to stop the drive-motor at the horizontal and vertical positions of the table. Final setting of the table, for the vertical position, is effected by the hand-wheel seen projecting from the back of the trunnion mounting *B*.

The three trunnion mountings, *A*, *B* and *C*, can be traversed towards, and away from, the tool-slide by means of the 7½-h.p. motor seen at *F*, Fig. 3. This motor is direct-coupled to a worm and wheel reduction unit, whence the drive is transmitted through torque-tubes, flexible couplings, and bevel-boxes, to the traversing screws. Provision is made for synchronizing the drives, and the rate of traverse in both directions is 30 in. per min. This movement is required primarily for withdrawing the worktable from the tool-slide, prior to rotating the former to the horizontal (loading) position, but is also used for rough, initial setting of the templates relative to the followers. The motor and worm reduction unit employed for this motion may also be seen at *F* in Fig. 1.

A fine-adjustment is provided for the template-carriers, which is also employed for applying the feed. After a complete cut has been taken over the workpiece, each template carrier is moved

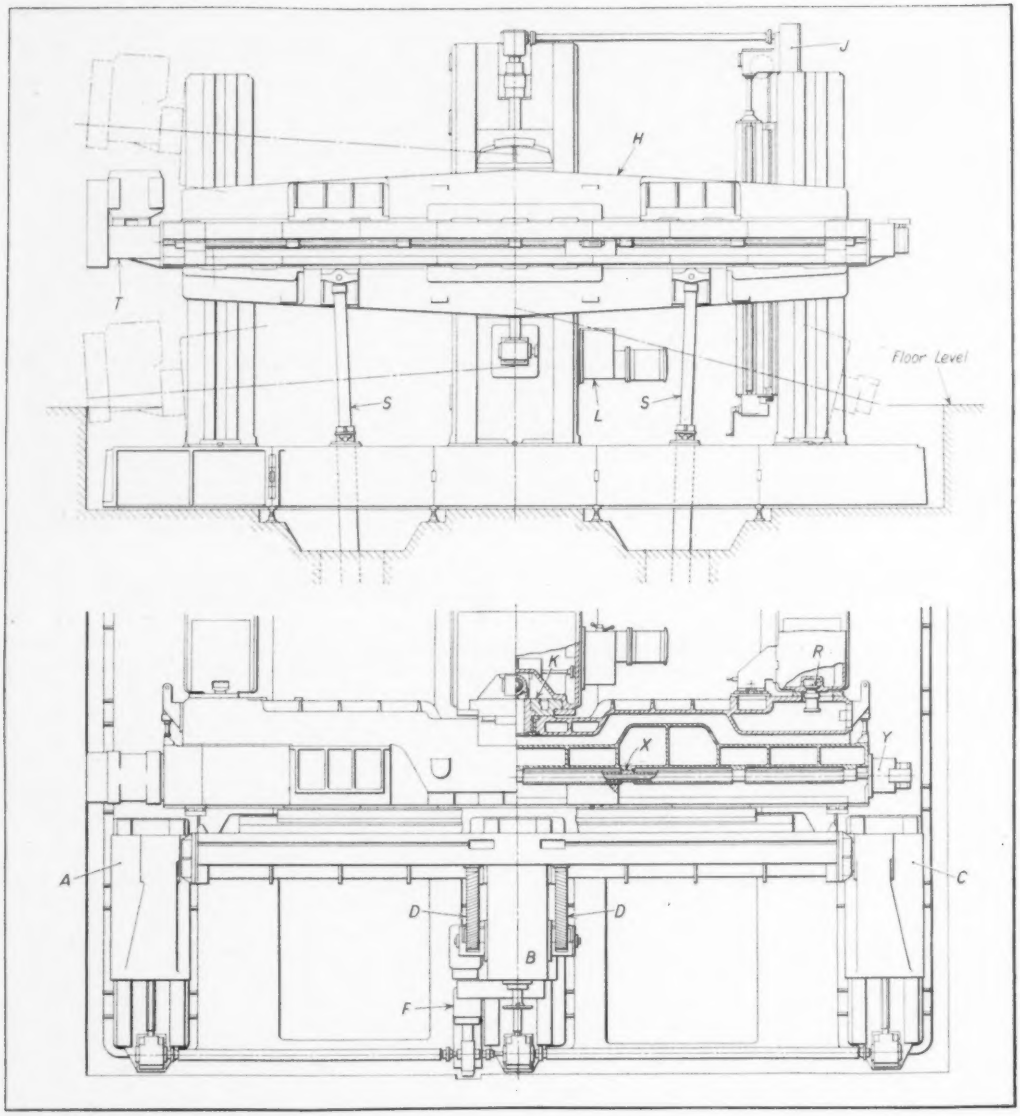


Fig. 1. Front and Part-plan Views of the Jameson Universal Production Aerofoil Generating Machine

away from the tool-slide. As a result, the tool-slide must then be advanced further, in order that the knife-edges can contact the templates, and the tool will take a fresh cut on the blank. A close-up view of the left-hand template-adjusting mechanism is given in Fig. 4, the worktable being seen in the horizontal (or loading) position. The template-carrier *G* is of welded steel construction, and is supported on two 4-in. diameter steel quills, which have 10 in. of axial adjustment in cast-iron housings attached to the end of the worktable. At the lower-end of each housing there is a worm

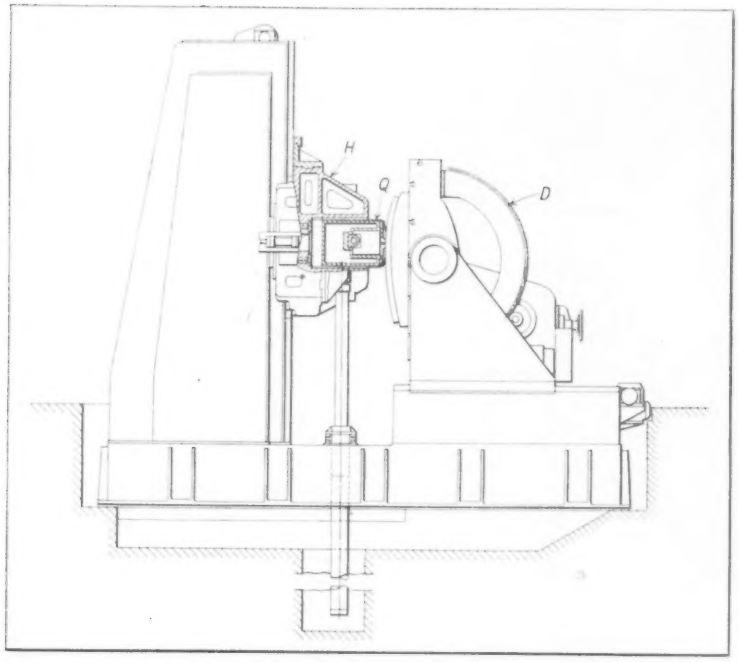


Fig. 2. End Elevation of the Aerofoil Generating Machine Shown in Fig. 1

and wheel, the latter being mounted on a traverse screw which engages with an internal thread in the sliding quill. The two worms are coupled by a shaft, at the left-hand end of which is a hand-wheel, and a micrometer collar graduated in 0·001-in. divisions. This arrangement is also used for setting the templates relative to one another. In addition, it allows for initial differential setting of the two templates, so that imperfectly-formed blanks may be "brought-in." After the position of the templates has been adjusted, the sliding quills are locked by the pad-bolt seen at the upper-end of each housing.

SWIVELLING BEAM

The swivelling-beam, *H*, Fig. 1, is 27 ft. long, 6 ft. deep at the centre portion, weighs approximately 15 tons, and is arranged to swing through a maximum angle of 15 deg. above and below the horizontal. The cross-sectional form of this massive casting is indicated in Fig. 2, where the position of the hydraulic rams which support some of the weight of the beam is also shown. The tool-slide *Q*, Fig. 2, is a sliding fit within the swivelling-beam, and careful attention had to be paid to the accuracy of machining, when the slot to receive this member was planed. As a complete unit (that is swivelling-beam, tool-slide, and tool-box drive), this assembly weighs approximately 28 tons.

A part-section of the pivot and central traverse screw for the swivelling - beam is shown in the plan view, Fig. 1. The 5½-in. diameter, 1-in. pitch, elevating screw is housed in the throat of the centre column, and engages a 12-in. long nut of Dyn-bronze grade GZ10, secured to the back of the vertically-sliding saddle *K*. Mounted on this saddle is the 15-in. diameter pivot, which is in the form of a hardened and ground steel sleeve with a centrally-disposed bolting flange. The rear portion of the sleeve is a force-fit in the saddle *K*, to which it is secured by a number of close-pitched bolts passing through the centre flange, and the front portion serves as the inner-track for a ring of crowded rollers. These rollers are of case-hardened and ground En. 32 steel, 1 in. diameter by 7½ in. long, and their outer-track is formed by a hardened and ground steel sleeve pressed into the back of the swivelling-beam casting. A 1½-in. thick, circular steel plate, bolted to the forward end of the pivot sleeve, restricts the end-wise float of the rollers, and locates the swivelling-beam at its centre. The extreme ends of the beam are retained against the front faces of the right- and left-hand columns by hydraulic clamps, the operation of which will be described later.

AUTOMATIC POSITIONING OF THE SWIVELLING BEAM

When planing a wing-blank, chord-wise feed (across the workpiece) is obtained by incremental vertical traverse of the swivelling beam. This motion can be effected in two ways, depending on the shape of the wing concerned.

Firstly, for wing panels which are parallel in the

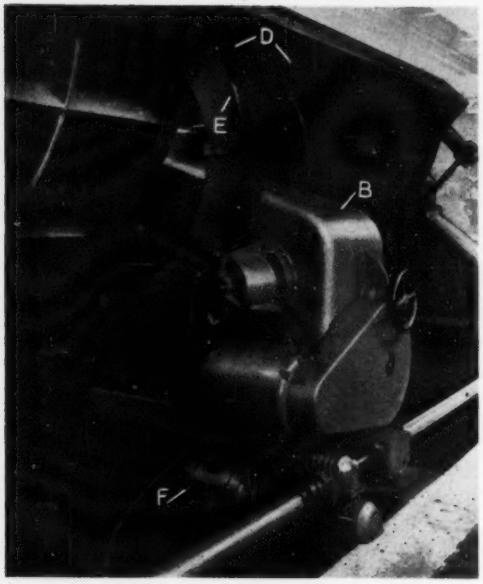


Fig. 3. Drive Arrangements for Pivoting the Worktable. This Table Weighs Approximately 20 tons, and can be Swung from the Horizontal to the Vertical Position in 35 sec.

span-wise direction, and for certain milling operations, the beam can be raised and lowered incrementally, or continuously, while remaining horizontal, by means of the main elevating screw in the centre column and the "tapering" screw carried on the inner-face of the right-hand column. In this instance, the tapering screw is driven directly by the central screw, and an amount of traverse is thereby imparted to the right-hand end of the beam which is equal to that applied at the centre. Alternatively, the tapering screw can be arranged to impart an incremental, or continuous, traverse to the right-hand end of the beam, which is larger, or smaller, than that applied at the centre, in which case the beam will swivel, about its central pivot, as it is traversed. To meet this requirement, the tapering screw is then driven, by the centre screw, through change gears contained within the housing *J*, Fig. 1 and 4, on top of the right-hand column. These gears will be in the same ratio as the actual, or projected, chordal widths of the wing measured at points coincident with the vertical centre-lines of the central and tapering screws.

The drive for the centre screw, it will be noted, is the prime mover for both methods of positioning the beam, and at the lower-end of this screw there is a wormwheel, the associated worm being coupled to the 12-speed gearbox indicated at *L*, Fig. 1. This gearbox is carried on the right-hand side of the centre column, and is driven by a flange-mounted, constant-speed, 7½-h.p. A.C. motor, which has special characteristics. A close-up view of this motor and gearbox is given in Fig. 5, and, when it is required to apply intermittent feed to the swivelling-beam, the rotor of the motor *M* is arranged to rotate through exactly 12 revolutions for each increment of feed. The cam *N* is driven, by the motor shaft, through a 12:1 reduction, and when this cam has made one complete revolution it operates a switch which interrupts the supply of current to the motor *M*, and applies

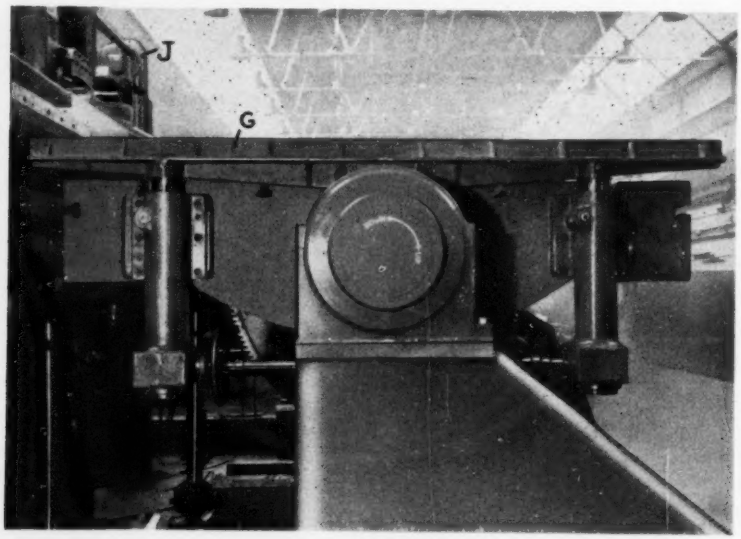


Fig. 4. Close-up View of the Left-hand Template Carrier and Adjusting Mechanism. The Worktable is here shown in the Horizontal (or Loading) Position

plug-braking to the stator windings. For each feed increment, therefore, the input shaft of the gearbox *L* makes 12 complete revolutions.

For initial setting of the machine, or when the milling attachment is in use, it is necessary to apply continuous vertical traverse to the swivelling-beam, and this is obtained by depressing the switch *P*, which cuts-out the 12-revolution feature of the driving motor, and allows it to be run continuously, at a speed of 680 r.p.m. The gearbox provides a range of incremental feeds for the planing operation, varying from 0·015 to 0·55 in., and an additional fine-feed range, varying from 0·0075 to 0·275 in. For milling, 12 feed rates, ranging from 0·867 to 32·43 in. per min., are available, and the highest feed rate is used, with the drive motor running continuously, for initially-positioning the swivelling beam.

When it is required to plane a wing which tapers in the spanwise direction, the swivelling beam must be set, initially, for angle of inclination, and to facilitate this adjustment a separate 1½-h.p. motor, is provided. This motor, which drives the tapering screw only, is mounted on top of the right-hand column, and its position is indicated by a part-dotted circle behind the change-gear box, *J*, Fig. 1. A control lever, with a 3-position gate, is located at the bottom of the inside face of the right-hand column, and with the lever in the right-hand position, the tapering-screw is connected to the central screw, and drive is transmitted in the manner previously described. For initially setting the angle of the swivelling-beam, this lever is set in the left-hand position, so that the drive from the centre screw is disconnected, and the tapering-screw can be rotated by the 1½-h.p. motor already mentioned. For fine angular setting, the control lever is moved to the central position, which disconnects the tapering-screw from both drives, and leaves it free to be rotated manually by a crank-handle.

During the dwell period at the completion of each cutting stroke, the hydraulic clamps which lock the swivelling-beam to the right- and left-hand columns, during planing, are released, so

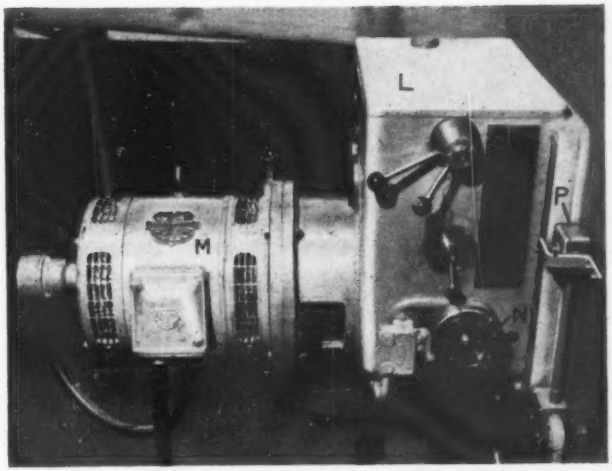


Fig. 5. The Gearbox and 7½-h.p. Motor Used for Elevating the 28-ton Swivelling-beam and Tool-slide. When this Gearbox is used for Raising the Beam to Apply Planing Feed, in Pre-set Increments, the Motor Shaft is Arranged to Rotate Exactly through 12 Revolutions for Each Movement

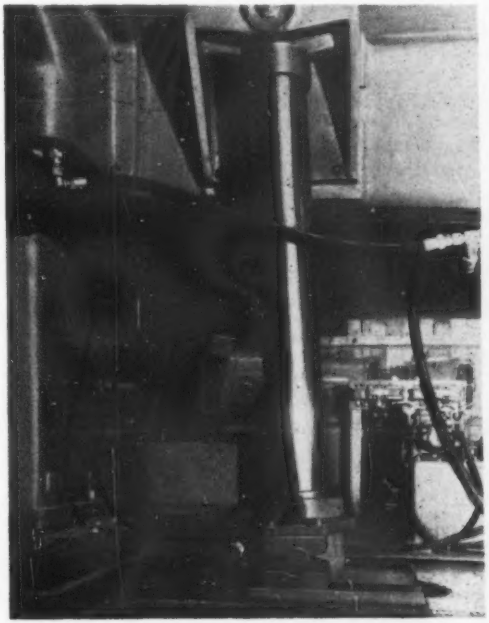


Fig. 6. One of the Single-acting Hydraulic Rams used for Supporting 85 per cent of the Weight of the Swivelling-beam. The Cylinder is Pivot-mounted at its Upper End

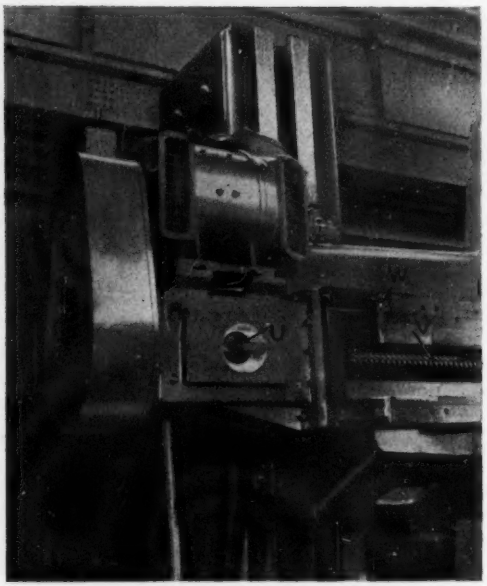


Fig. 7. A Close-up View of the Gearbox and 25-h.p. Drive Motor for the Tool-box Traverse Screw. The First Section of the 6-piece, 7½-in. Lead, Traverse Screw can also be Seen

that the beam can be adjusted vertically and angularly, and the right-hand clamp can be seen at *R* in Fig. 1. Each clamp is operated by a 5½-in. diameter, double-acting, hydraulic cylinder, mounted inside the swivelling-beam, and the clamping plate pulls up on a pair of machined faces inside the column. These clamps are arranged to float, in slots in the beam, to accommodate the small amount of horizontal movement which results from the ends of the beam describing an arc as it pivots.

Approximately 85 per cent of the weight of the swivelling-beam, tool-slide, and tool-box drive is supported by the two single-acting hydraulic rams, S, Fig. 1. A close-up view of the left-hand ram is shown in Fig. 6, where the 6-in. diameter piston rod, and the attachment point on the underside of the beam, can be seen clearly. The cylinder for this ram is pivoted at its upper-end, on a bracket fixed to the top surface of the machine bed, and the remainder of the cylinder is housed in the 30-in. square pit already mentioned. It was necessary to pivot-mount these balancing rams in order to accommodate the swivelling motion of the beam, and, as may be seen in Fig. 1, when the beam is in the parallel position, the upper ends of the balancing rams are inclined outwards. This initial inclination allows the total angular movement of the rams to be more evenly distributed about the vertical centre-lines. The lower-ends of the cylinders are interconnected, and pressure oil is supplied from a separate hydraulic pump and tank assembly. As the beam pivots, one piston rod is depressed, whilst the other is extended, and oil flows from the former to the latter, system pressure being maintained constantly by a relief valve.

HYDRAULICALLY-OPERATED TOOL SLIDE

A cross-section through the 27-ft. long tool-slide can be seen at *Q* in Fig. 2, and this casting is arranged to slide transversely in a 22-in. wide by 27-in. deep channel in the swivelling-beam. The tool-slide is free to take up any position relative to the worktable, as determined by the position and form of the templates. End-wise movement is prevented, however, by a locating pin which is fixed in the swivelling-beam, and engages a slot in the top surface of the tool-slide. At the right in Fig. 9 can be seen one of the pair of double-acting hydraulic cylinders which is employed for moving the tool-slide towards, and away from, the templates. Each cylinder is trunnion mounted, at the head-end, on a bracket bolted to the swivelling-beam, and has a maximum stroke of 10-in. Regardless of the extent to which the piston-rod is extended, when advancing the tool-slide, the withdrawal movement, for relieving the latter from the templates, is always a pre-set amount, in practice, approximately $\frac{1}{16}$ in. This movement is obtained by means of a special metering valve, of the company's design, incorporating an axially-moving spool which allows a pre-determined volume of oil to be metered into the rod-end of the cylinder, when the head-end is opened to the reservoir. It is stated that only a small amount of pressure is required to move the tool-slide, and that, consequently, only a light load is applied to the tip and root templates by the knife-edges.

The tool-box reciprocates in a 12-in. wide by 13½-in. deep slot machined in the tool-slide, and is retained by the cast-iron gib plate at W in Fig. 7. There are 16 of these plates, each 37-in. long, tenoned and screwed to the front of the tool-slide, and the upper and lower edges of the plates form a dove-tail slide for the milling attachment previously mentioned. The final accuracy of planing achieved by the machine is largely dependent on the straightness of the slideways in the tool-slide, and it is stated that this was maintained to within 0·008 in. over the total length (27 ft.).

DRIVE TO THE TOOL-BOX

Depending upon the shape and size of the workpiece, it is frequently necessary to use a vacuum chuck to hold the blank, and such chucks must certainly be employed for holding a machined aerofoil when planing or pocket- and rib-milling of the underside is in progress. For such an application, the holding-surface of the chuck may have to be machined to a concave form which is the reverse of the finish-planed convex aerofoil on the workpiece, and the Jameson machine can be used for planing its own vacuum chuck. Traverse motion for the milling-head attachment is obtained from the same screw which reciprocates the planing tool-box. When considering the drive to this screw, therefore, it was necessary to provide a range of traverse speeds which, at one extreme, was suitable for planing light-alloy material, and, at the other, gave feed rates which were suitable for a milling operation. Also between these two extremes, a traverse speed was required for planing the cast-iron vacuum chucks, and the drive which was adopted comprises a variable-speed D.C. motor of 25 h.p., and a two-stage epicyclic gearbox, *T*, Fig. 1. This arrangement gives a tool-box traverse speed range from 2½ in. per min. to 300 ft. per min., and a close-up view of the gearbox and driving motor, which is mounted on the left-hand end of the tool-slide, is shown in Fig. 7.

The variable-speed D.C. motor, seen mounted on top of the gearbox, has a 10:1 speed range, for planing, and a 20:1 low-power range for milling. Drive is transmitted to the epicyclic gearbox through pulleys and V-belts, which provide an initial built-in reduction of 2·3:1, and a cross-sectional view of this gearbox is given in Fig. 8. The design is such that drive from the input pulley may be transmitted to the traversing screw at ratios of 1:1, 3·818:1 and 63:1, and these ratios are applicable to planing light-alloy; planing cast-iron and steel; and milling light-alloy, respectively.

Referring to Fig. 8, it will be seen that the input pulley shaft is mounted on its own ball and roller bearings, and is direct-coupled to the shaft *a*, which carries the two sun-gears of 20 and 22 teeth, *b* and *c*. There are two 20-tooth planet gears meshing with the sun-gear *b*, which are mounted on needle bearings in the spider *d*, and the four identical planet gears for the sun-gear *c* are carried in a similar manner in the spider *e*. It should be noted that the spider *e* is bolted to the output shaft of the gearbox. The annulus gears of the

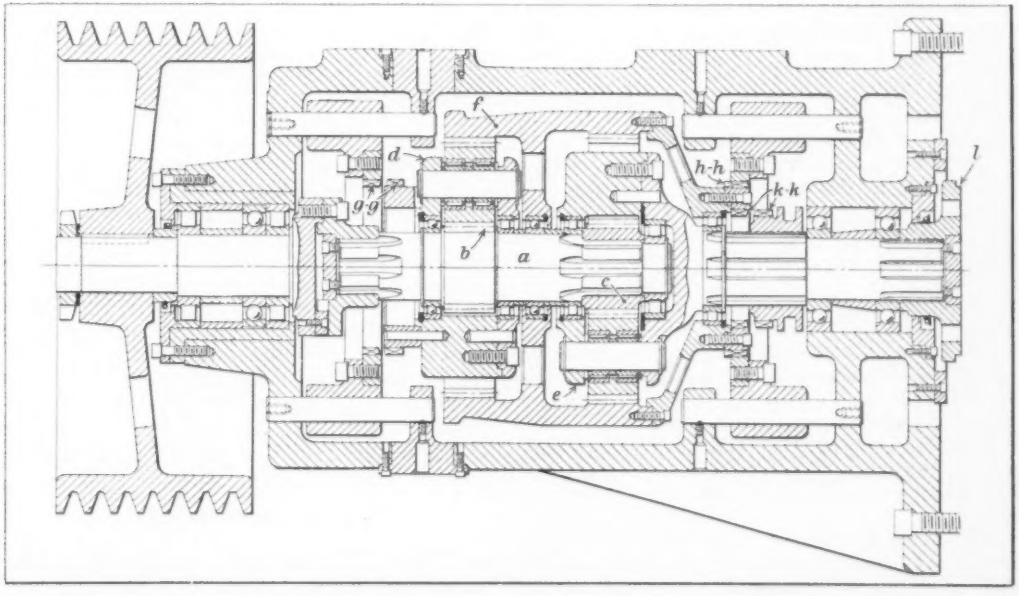


Fig. 8. A Sectional-view of the 2-stage Epicyclic Gearbox Used to Drive the Tool-box Traversing Screw. Driven by a Variable-speed D.C. Motor, this Gearbox Provides Tool-box Traverse Rates Ranging from 2½-in. per min. to 300 ft. per min.

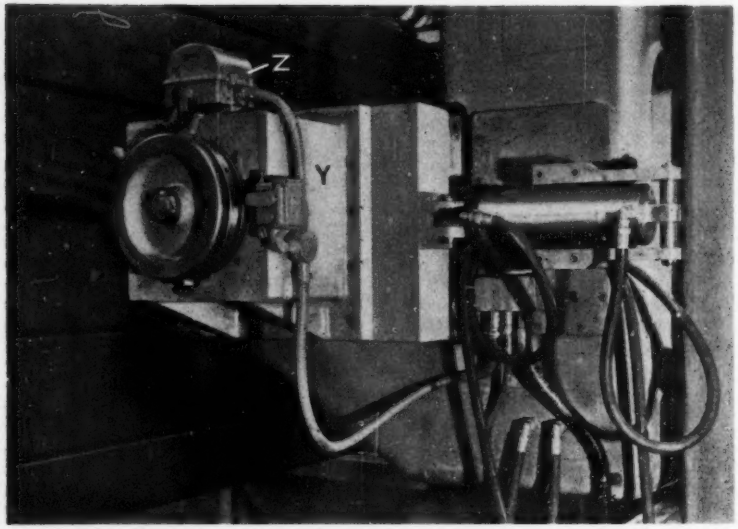


Fig. 9. The Epicyclic Gearbox and Cam-drum mounted on the Right-hand End of the Tool-slide. Adjustable Trips on the Periphery of the Drum operate the Switch *Z* to Initiate the Automatic Re-positioning of the Swivelling-beam at the Completion of each Cutting Stroke. At the Right can be seen One of the Hydraulic Cylinders Employed for Advancing and Retracting the Tool Slide

epicyclic are both formed in the drum *f*, which is supported by a central web carrying a ball bearing mounted on the shaft *a*, and by a roller bearing carried in a dished plate at its right-hand end.

There are three sliding clutch members, formed by meshing internal and external gear-rings, and these clutches are indicated at *g-g*, *h-h*, and *k-k*. In Fig. 8, the gearbox is shown set to provide a ratio between the input and output shafts of 3·818 : 1, and it will be noted that the clutch *h-h* is shown engaged, in order to hold the annulus drum *f* stationary. In this instance, the planets meshing with the sun-gear *b* are free to idle, as the clutch *g-g* is disengaged, and a reduction is effected by the second set of planet-gears only. As the sun-gear *c* rotates, its associated planets are driven around the stationary annulus at the right-hand end of the drum *f*, and the resultant rotation of the spider *e* is transmitted directly to the output shaft.

To obtain the greatest reduction of the input speed, the clutch *g-g* is engaged, and the clutches *h-h* and *k-k* are disengaged. With this setting the first spider, *d*, is held stationary, and the drum *f* is driven by the sun-gear *b*, and its planet gears, at a reduced speed, and in the opposite direction. A reduction occurs at the second set of planet gears, where, as a result of the difference between the speed and direction of rotation of the drum *f* and the sun-gear *c*, the spider *e* (and the output shaft), are driven at a reduction of 63 : 1 in relation to the input shaft.

Finally, if the clutch *k-k* is engaged, and the remaining clutches are disengaged, the output shaft is driven directly by the input shaft. The engagement of the clutch *k-k* not only locks the annulus drum *f* to the output shaft, but, as the spider *e* is also bolted to this shaft, *e* and *f* are effectively joined. As a result, the four planets in the spider *e* act only as a direct connection between the sun-gear *c* and the annulus drum *f*, and do not rotate on their axes. In effect, therefore, the input shaft is connected directly to the output shaft, and the entire assembly of sun-gears, planets, and annulus drum rotate as one complete unit.

Engagement and disengagement of the three sliding clutches is effected by the handle *U*, Fig. 7, which drives, through reduction gearing, a cam plate inside the gearbox. It is arranged that one revolution only of the handle *U* is required to select each speed range, and in addition to engaging the necessary clutch, the cam is designed to disengage those which are not required. The bevel-edged disc seen underneath the handle *U*, in Fig. 7, is mounted on the outer end of the cam plate shaft, and rotates with the latter. Figures engraved on this disc are read against a pointer on the gearbox casing, and indicate which speed range is engaged.

TOOL-BOX TRAVERSING SCREW

The 5½-in. diameter tool-box traversing screw is more than 27 ft. long, and, as it is carried in the tool-slide in a horizontal position, there are seven support bearings, spaced at 4 ft. 6 in. centres, along its length. An unusual method was employed for

the construction of the screw, in that it was made up of six, separate, threaded cylinders, assembled at 4 ft. 6 in. centres on a common shaft. Each of the cylinders is 5½ in. outside diameter, by 48 in. long, with a bore size of 3 in., and the 1¼-in. pitch, 6-start, 7½-in. lead thread was milled on the outside of each cylinder. Then, the first section was taper-pinned in the required position on the 3-in. diameter centre shaft. Next, the second threaded section was assembled on the shaft and the adjacent ends of the two cylinders were brought together. The 24-in. long half-nut, which was subsequently secured to the back of the tool-box, was then brought into engagement with the two threaded sections, to ensure continuity of thread form from one portion to the other. Next, the un-pinned section was rotated, whilst still in engagement with the half-nut, and in this manner the distance between the inner end faces of the two pieces was set to the required dimension. Finally, the second section was taper-pinned to the centre shaft. The foregoing procedure was repeated for positioning and assembling each of the remaining pieces. Each threaded section is held by four ⅞-in. diameter taper pins.

One of the support bearings for the traverse screw is indicated at *X* in Fig. 1. These bearings are of Dyn-bronze GZ.14 grade, and the maximum diameter of the bearing is arranged to be less than the root diameter of the thread on the screw, in order to clear the crest of the thread on the half-nut. This half-nut is of Dyn Pan B lead bronze, and the thread was milled by a specially-designed attachment which was fitted to an 18-in. precision centre lathe of the company's own design and construction.

The left-hand end of the traverse screw is direct-coupled to a flange on the output shaft of the two-stage epicyclic gearbox, *l* Fig. 8, and the axial thrust of the screw is taken by two heavy-duty, 3-in. diameter bore, taper-roller bearings mounted in the housing at the right-hand end of the tool-slide. This housing, which is indicated at *Y* in Fig. 1 and 9, contains a simple epicyclic unit through which the cam-drum, seen at the left in Fig. 9, is driven, from the traverse screw, at a reduction of 44:1. The drum has two T-slots in its periphery, the inner slot carrying trips to operate the automatic cycle switch *Z*, and the outer-slot carrying trips which actuate the safety over-run switch seen mounted on the side of the housing. It is arranged that the cam-drum rotates through a total of 310 deg. for each 24 ft. (maximum) stroke of the tool-box.

When the tool-box reaches either extreme of its pre-set travel, the switch *Z* is operated, and there is a pause of approximately 4 sec. while the swivelling-beam is re-positioned. During this dwell period, the following automatic sequence takes place. (1) The drive motor for the tool-box traverse screw is stopped. (2) The hydraulic clamps that lock the tool-slide to the swivelling-beam, and the beam to the end columns, are released. (3) The tool-slide is withdrawn a pre-set amount into the swivelling-beam, to relieve the knife-edges from the templates. (4) The swivelling-beam is adjusted for height and inclination, in the manner previously described. (5) The tool-slide

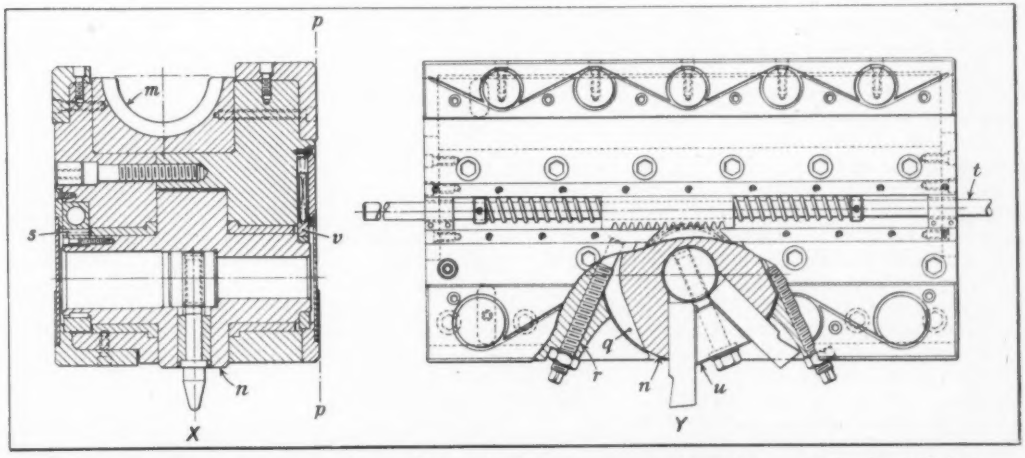


Fig. 10. Cross-sectional and Plan Views of the Tool-box and Pivoting Tool-holder. Hydraulic Cylinders, Mounted on the Tool-slide, Operate the Push-rod *t* to Pivot the Tool-holder at the End of Each Cutting Stroke

is advanced until the knife-edges re-contact the templates in a fresh position. (6) All the hydraulic clamps are re-applied. (7) The drive motor for the tool-box traverse screw is re-started, in the reverse direction.

The automatic cycle just described is initiated by operation of the switch Z, Fig. 9, and is under the control of switch-gear housed in a large cabinet. This electrical control system was designed and built specially for the machine by Allen West, Ltd., Brighton, as was the operator's control desk.

TOOL-BOX ARRANGED FOR 2-WAY CUTTING

As has been mentioned already, a cut is taken on the workpiece in each direction of tool traverse, and a line-drawing of the tool-box and pivoting tool-holder, which was designed to meet this requirement, is shown in Fig. 10. The body of the tool-box, which is 24 in. long, is of cast iron, and, as can be seen in the view at X, Fig. 10, is made in two sections, which are bolted and dowelled together. Case-hardened and ground, L-shaped and flat, steel guide strips are provided at the corners, and these strips have circular oil grooves in their rubbing faces. It should be noted that when the tool-box is in position in the tool slide the face *p-p* is downwards. The half-nut *m* extends for the full length of the tool-box, and is located in a 6½-in. wide by 3¼-in. deep slot, machined in the body portion. Two 4-in. diameter, hardened, steel bushes are provided for the pivots of the tool-holder *n*, which has an 8-in. diameter by 3¼-in. wide centrally-disposed flange portion. Angular movement of the tool-holder is controlled by means of the adjusting screws *r*, which are arranged to abut the ends of slots milled in the central flange portion. As shown in Fig. 10, the tool-box is set for cutting from right to left, and the left-hand adjusting screw has limited the anti-clockwise rotation of the tool-holder.

Rotation of the tool-holder is effected by the segment gear *s*, which is fixed to the upper end, and engages a square-section rack. Referring to the view at Y, Fig. 10, this rack is free to slide on the ¾-in. diameter plain push-rod *t*, but is retained in a central position by means of compression springs and stop-collars.

At each end of the tool-slide is mounted a 10-in. stroke, double-acting, hydraulic cylinder, with the ram coaxial with the rod *t*, and when the tool-box pauses at the end of the stroke, the ram of the adjacent cylinder is extended, automatically, to push the rod *t*, and pivot the tool-holder. The length-wise position of these cylinders is adjustable, to cater for various lengths of cutting stroke, but is not critical, as the compression springs on the rod *t* accommodate any reasonable amount of over-run. Each cylinder is controlled by a solenoid-operated reversing valve, and these solenoids are energized during the automatic sequence which is initiated by the operating cycle switch Z, Fig. 9.

The planing tools, of 1¼- by 1-in. section, are clamped in the holder by means of the wedge-piece *u*, and a clamping screw which engages a threaded, cylindrical block contained in the bore of the tool-holder. The periphery of this block is ground to close limits, and, as the end of each tool is located against this surface, it is necessary only to grind a pair of tools to the same overall length, to ensure that each projects the same amount when it is in the cutting position.

A spring-loaded plunger *v* engages, alternately, a pair of detents formed in a reduced diameter portion of the lower bearing of the tool-holder, and serves to register the latter, positively, after it has been pivoted. This arrangement is intended only to obviate any "bounce" which may occur as the holder is rotated and arrested by the limiting screws *r*.

It is hoped, in a future issue, to publish a second article on this machine, in which the milling attachment, the means of positioning the workpiece on the worktable, and the control console and electrical circuit will be described.

CONTROL OF REVERSING MOTORS FOR PLANING MACHINES.—Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17, report that leading planing machine builders are co-operating with them in installing a new method of control for the main reversing motors. With this system, the field of a Ward-Leonard generator is supplied from a variable voltage exciter, which, in turn, is controlled by a magnetic amplifier with no thermionic valves and no moving parts. Output from the amplifier, and consequently the speed of the motor, is regulated by two small potentiometers which can be mounted in any convenient position on or near the machine. The cutting speed is set on one potentiometer and return speed on the other, and relays operated by the planer reversing switch select the cutting or return direction. A relay of the type used for this purpose is being subjected to an endurance test and has so far completed 17 million operations without failure.

As compared with rheostatic control of the Ward-Leonard generator, it is claimed that this system offers the advantages of smoother and more rapid reversal, and more accurate speed control, irrespective of load. It also eliminates the severe mechanical duty on contactors.

Indexing Drilling Equipment with Vacuum Clamping for Skin Panels

The Martin Co., U.S.A., have developed the indexing drilling equipment shown in Fig. 1 and 2 for drilling and countersinking the large numbers of rivet holes required in skin panels for the P6M jet-propelled seaplane which they build for the U.S. Navy. Normal procedure for carrying out this work would involve the use of large and costly laminated plastics jigs, attached to the panels, and provided with the required numbers of holes. With the set-up shown, the need for such jigs is obviated, and the equipment is stated to have permitted savings of approximately 85 per cent in tool-making cost and production time, in addition to ensuring better quality work.

Drilling and countersinking are carried out with a self-contained Air-Feed drill head which is mounted on a slide *A*, Fig. 1, arranged to move along the guide frame *B*. Location of the entire drilling unit is taken from two guide tracks *C*, Fig. 2, which are positioned by dowels, in holes provided for the purpose, and clamped to the skin panel. The spacing of the holes drilled in the panel is determined by notches in the lower edge of the bottom guide track, which are engaged by a lever-operated detent on the slide *A*.

The frame *B*, which is provided with feet at each end, and rests on the work, is arranged to pivot on the side arms *D* and *E*. These arms carry screw jacks *F* at the opposite ends, which also bear on the skin panel. The assembly comprising the frame *B* and the side arms *D* and *E* is supported on a cross-member *G*, welded to the plate *H*, which is held securely to the skin panel by vacuum. A venturi unit, operating from the shop compressed air system provides the required vacuum. When one row of holes has been drilled, the vacuum is released and the unit moved to the next position on the skin.

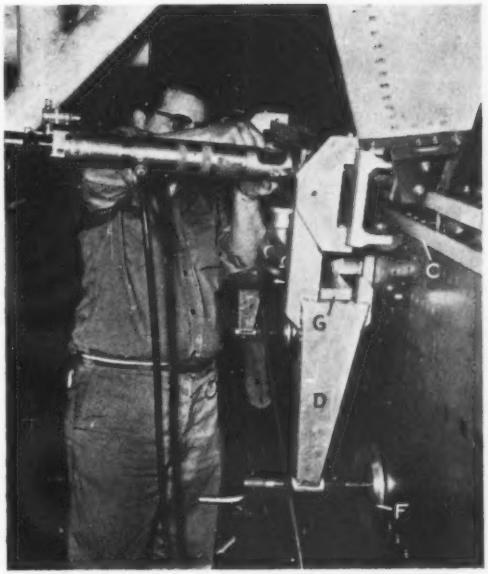


Fig. 2. End View of the Equipment Showing the Air-feed Drilling Head

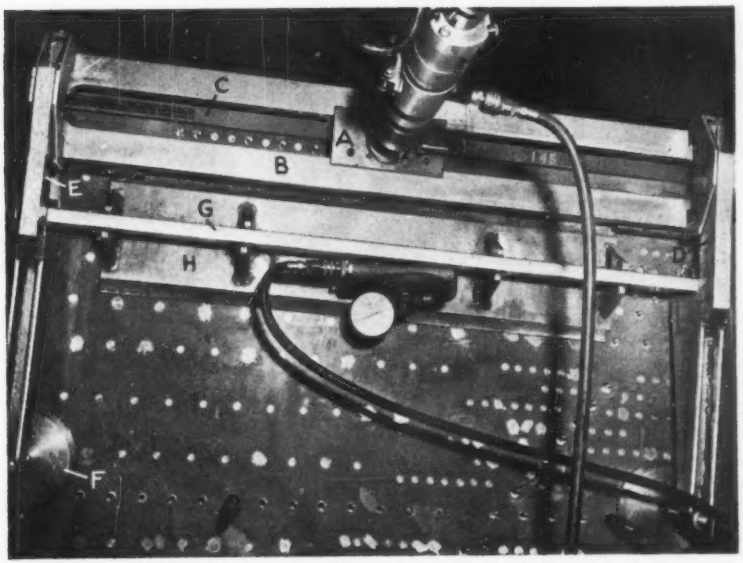


Fig. 1. Indexing Drilling Equipment with Vacuum Clamping, for Aircraft Skin Panels

Production of Distribution Transformers

New Layout in the Recently-established Works of Ferranti, Ltd., West Gorton, Manchester

In March, 1956, Ferranti, Ltd., took over extensive factory premises at West Gorton, Manchester, with the object of providing increased facilities for the manufacture of distribution transformers, also—in a separate section—electronic computing machines, for which the demand is steadily expanding. After extensive modernization of the works, production was started early in 1957, and the manufacture of Ferranti distribution transformers up to 1,500 kVA., 33 kV. is now concentrated in a most up-to-date plant, equipped with roller conveyor systems and specially arranged to ensure efficient work flow. It is stated that, with the new layout, the time cycle from the issue of raw material to the completion of an order has been reduced by 20 per cent. The policy of rationalizing design, which has been pursued progressively by the company, now enables 60 per cent of the transformers to be built as more or less standardized types, and batches of certain sizes are, in fact, made for stock to meet estimated demands.

In the planning department, the issue and progress of orders, and shop loading, is carried out with the aid of Produc-Trol control boards (Block & Anderson, Ltd.) which provide a ready indication of the production position at all stages. Operation instruction sheets for components and assemblies, which, for this class of work, are relatively simple, are prepared on standard printed forms, and, from a carbon copy, the required number of copies is produced by the Copycat duplicating system. Forward loading is arranged for monthly periods, from information supplied by the sales department, and it is determined from the actual cost of the transformers, which is found to afford a reliable basis. Typical Ferranti distribution transformers are seen in the view of the despatch bay, Fig. 1.

FABRICATION OF TANKS

The mild steel tanks, of arc-welded fabricated construction, are made in a separate section of the factory, by generally conventional methods. For the cooling oil circulating system, welded steel tube of 1½ in. or 2 in. diameter, by 16 gauge, is used. The tubes are bent to the required radius at each end on Brookes, mandrel-type, power-operated machines, and then are trimmed to final length on a Taylor cold circular saw, with hand feed. Before being welded into the tank sides, the tubes are cleaned in trichlorethylene. It may be noted that the Nelson stud welding process is being used with advantage in the construction of transformer tanks.

In this shop, also, are produced the rectangular core laminations, which are interleaved to form the core in the assembly section. At

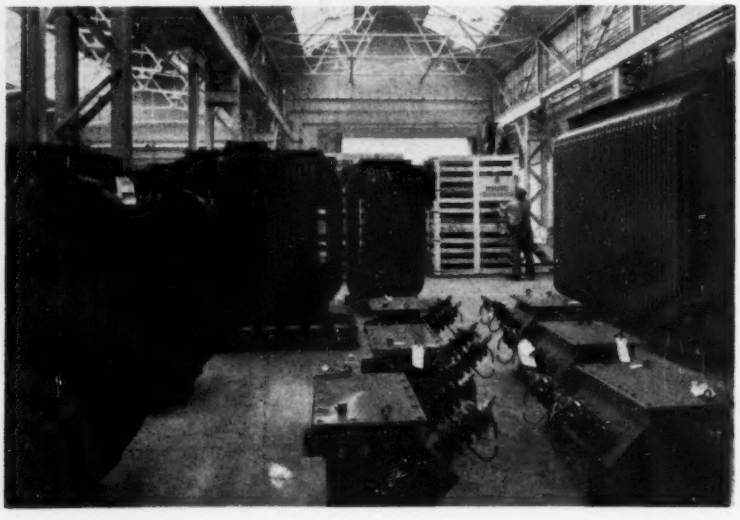


Fig. 1. Typical Ferranti Distribution Transformers in the Despatch Department at the West Gorton Works Manchester

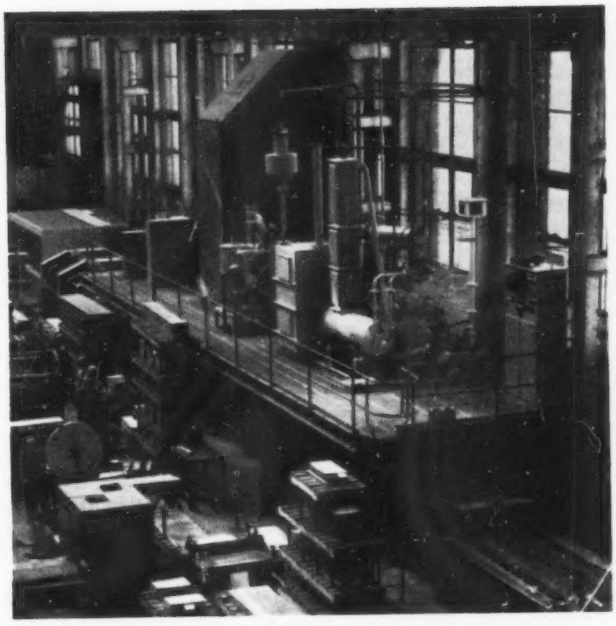


Fig. 2. Continuous Annealing Furnace for Transformer Laminations, Installed at the Hollinwood Works of Ferranti, Ltd.

the present time, high-temperature annealing of the laminations in a reducing atmosphere is carried out at the Hollinwood works in the continuous furnace installation seen in Fig. 2. A continuous furnace for this purpose, however, is to be provided in the West Gorton factory shortly.

The welded assemblies are thoroughly shot blasted in a recently-installed Tilghman's plant, and all tanks, and other vessels which are required to be oil tight, are tested for leaks by filling them with white spirit. The latter is supplied by gravity from an overhead tank, and is pumped back, through a filter, for re-use. Where tanks are provided with oil circulating tubes, the welded tube joints are additionally inspected for leaks by the application of Glomor dye penetrant [Manchester Oil Refinery (Sales), Ltd.]. The dye penetrant, contained in a conventional oil can, is applied to the outside of the joint, and any leaks are revealed by specks of green light on the inside surface when the latter is illuminated by an ultra-violet lamp, in this case supplied by Hanovia, Ltd. For convenience, in some instances, the test is carried out before the tank bottom plate is welded in, to permit easier access to the inside should a tube require to be re-welded.

Work is transported to the test bay on trolleys, which move along a rail and turntable system, and are of the same height as low-level, roller conveyors on to which the tanks are transferred, after test, for movement through an adjacent assembly section, as seen in Fig. 3. Here, such parts as cable boxes, oil valves, and drain plugs, are fitted, and the tanks then pass into the painting section shown in Fig. 4, where a durable weatherproof finish is applied. The smaller tanks are suspended from trolleys on a monorail conveyor, and a primer and two finishing coats are sprayed on by hand in two

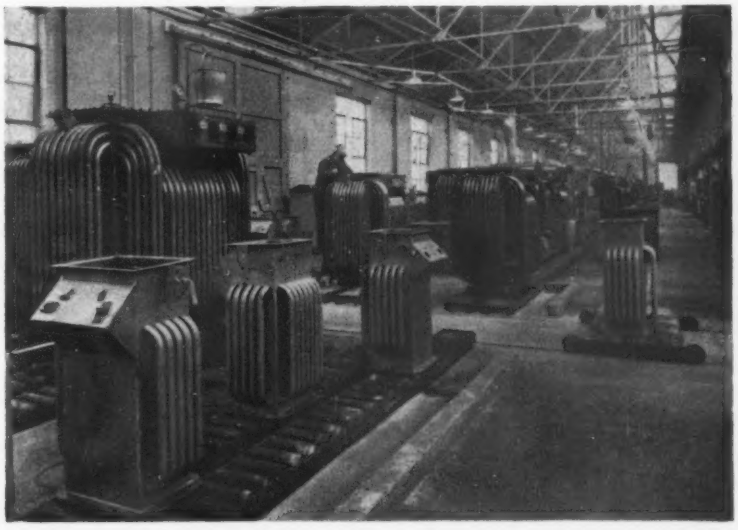


Fig. 3. A View of the Tank Shop, Showing the Roller Conveyor System

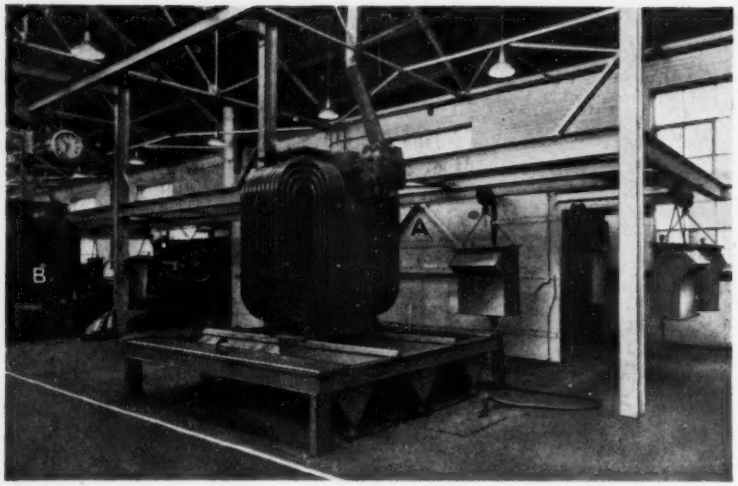


Fig. 4. Flow Painting Installation for the Larger Sizes of Transformer Tanks

Bullows booths, seen in the background, on the left. After they have been sprayed, the tanks are moved along the monorail into the stoving oven *A*, on the right. Tanks for all transformers up to 100 kVA., also the small metal components, receive this stove-enamel finish.

For the larger tanks, which have two or more rows of cooling tubes, the primer and two finishing coats are applied by the flow coating technique, and the work is not subsequently stoved. With this method, very rapid and certain coverage is obtained. In addition it is relatively clean, and results in little wastage of paint. The prime painting station is seen at *B*, and the finish painting station at *C*, and both these units were designed and built by Ferranti, Ltd. An overhead monorail and a Felco electric hoist block are provided for handling the tanks, and for painting, the tank is supported centrally on two cross members over three V-shaped drain troughs incorporated in the framework. Each trough slopes towards a filter gauze and drain pipe whereby the paint is returned to a small, under-floor supply tank at the right-hand side. The paint is delivered from this tank through a flexible hose and hand nozzle, by means of a Brooke No. 4 gear pump which runs at 530 r.p.m., and has a capacity of 350 gal. per hour. Cleanliness is readily maintained by the use of thin polythene sheet, which is laid in the V-troughs and is renewed once a fortnight. The viscosity of the paint is checked each day.

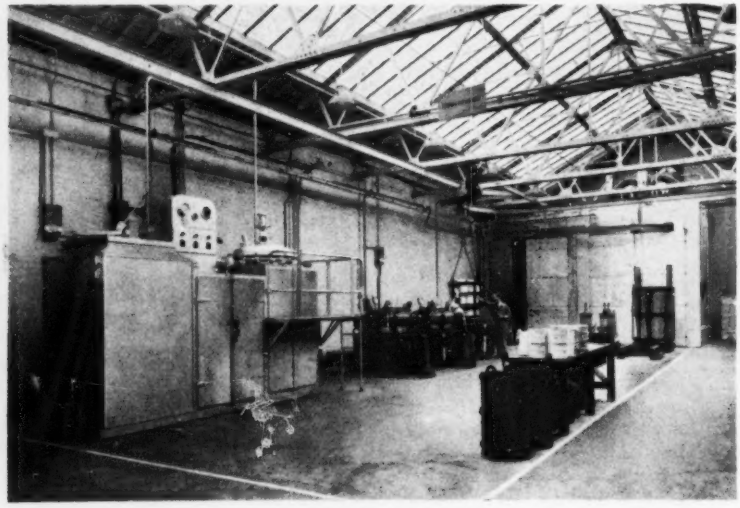


Fig. 5. A View of the Vacuum Impregnating Plant for Transformer Coils

COIL AND CORE ASSEMBLY

Typical coil and core assemblies may be seen in Fig. 6, mounted on a roller conveyor system whereby they are moved from one stage to the next. The primary and secondary coils are wound on power-driven, heavy - duty winding heads of generally conventional type, and they are afterwards carefully

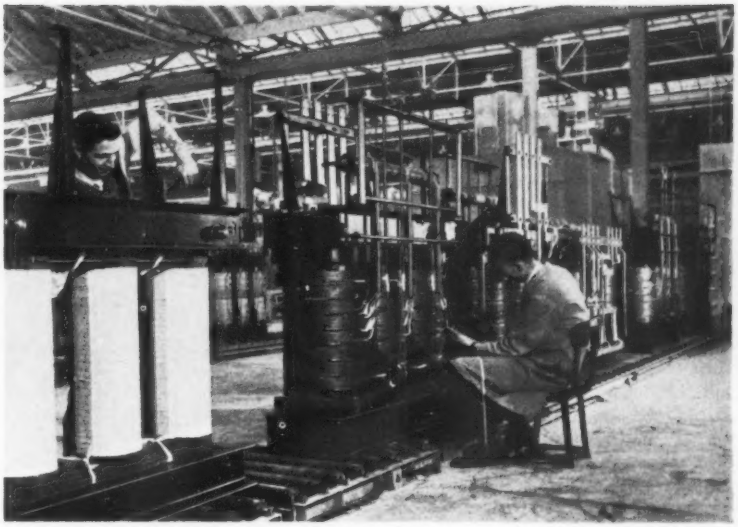


Fig. 6. Assembling Transformer Coils and Cores on One of the Roller Conveyor Lines

vacuum impregnated in the plant seen in Fig. 5. There are three impregnating pans and two large steam-heated, thermostatically-controlled stoving ovens. In addition, a separate Barlow & Whitney plant, seen on the left, is installed for impregnating coils with silicone-base resins and varnishes, for transformers with Class C insulation. Before they are impregnated, the coils and associated insulations are pre-assembled, to a specified height, on a centre rod, between end plates, which are tightened by a nut. This end pressure is maintained until the coils are assembled on to the transformer leg.

The roller conveyor system, seen in Fig. 6, for the main assembly of the coils, core, and electrical connections, comprises four lines, and the line for the smaller transformer has two levels, connected by an air lift table for convenience in carrying out the various operations. Plug-in air, electrical, and gas points are provided at 6-ft. spacing on the conveyor frames, for use by the operators. Turn-tables are incorporated whereby the work is turned through 90 deg. on to roller conveyors associated with four ovens in which the assemblies are finally dried out before being loaded into their tanks.

Two of the ovens, supplied by Browns Dryers (British), Ltd., are electrically heated, and the other two, by Controlled Heat & Air Co., Ltd., are steam heated. One of the latter ovens, seen in Fig. 7, is provided with two conveyor lines, and the conveyor-runs within the oven are power driven. Floor rails, extending transversely across the front of the ovens, and a trolley-mounted section of roller conveyor *A*, enable transformers from any assembly conveyor to be loaded into a selected oven. Before the coil and core assembly is moved into the oven, an electrical test is made for ratio, polarity, and circuit continuity. The work is maintained at a temperature of 110 deg. C. for about 24 hours, and is then removed through doors at the rear, still on a roller conveyor.

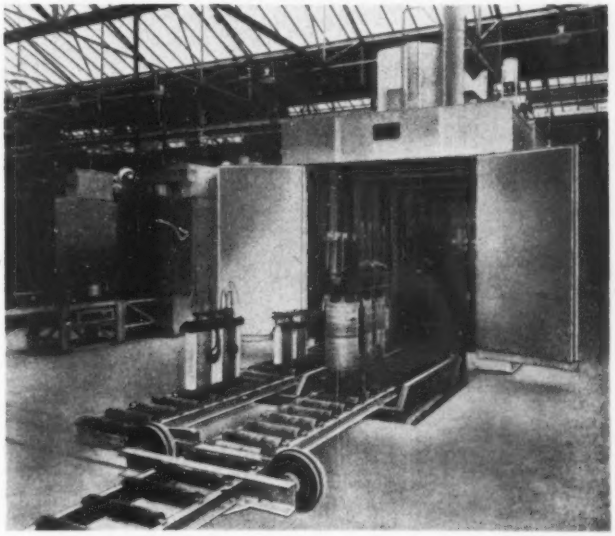


Fig. 7. Part of the Drying Oven for Coil and Core Assemblies

FILLING THE TANKS WITH OIL

Above the roller conveyors at the outlet side of the drying ovens, there is a 5-ton travelling crane, whereby the coil and core units are lifted and lowered into their tanks, the latter having been moved on to the conveyors from an adjacent storage area in readiness to receive them. An exception is made in the case of tanks for the larger transformers, above 500 kVA. rating, which, on account of limited crane height, are placed in a 10 ft. sq. by 6 ft. deep pit for the assembly operation.

After the connections have been made between the windings and the cable box, each tank is filled with transformer oil, and this operation, which is the subject of careful control, is seen in progress in Fig. 8. It is very important to ensure that the oil used is of the required standard as regards insulation and other properties.

Bulk supplies of transformer oil are delivered direct by road tanker vehicles to covered overhead storage tanks alongside the building, each tank being fitted with dehydrating breathing apparatus. Before a consignment is accepted, a sample is carefully tested. From the storage tanks, the oil passes through a large-capacity Streamline filter and pump unit, and the efficiency of filtering, it is stated, ensures the maintenance of electrical breakdown properties appreciably better than those demanded by relevant B.S. Specification.

Filtered oil is delivered to a storage tank above the roller conveyor lines, in which it is continuously circulated through a heat exchanger, whereby the temperature is maintained constant at about 60 deg. C. This temperature corresponds approximately with that of the coil and core units when they are ready for oil-filling, so that unduly rapid cooling of the transformer assembly is avoided. The tanks are conveniently filled with the specified quantities of oil by means of conventional petrol pump units, supplied by the Wayne Tank & Pump Co., Ltd., as seen at A, which register the flow in gallons. Another small pump is incorporated in the system to enable a transformer tank to be emptied, should this be necessary for any reason, and the oil is then returned to the main storage tank for re-filtering. A change-over valve is also provided, so that a tank can be filled with cold filtered oil, if desired. Three of these filling stations are provided, and the Wayne unit employed for the larger transformers is fitted with a Veeder automatic trip counter, which can be pre-set to stop the pump when the required quantity of oil has been delivered. The oil is tested each day to ensure that the required cleanliness and electrical breakdown properties are being maintained, and a Streamline filter is provided in the section so that any contaminated oil can be purified.

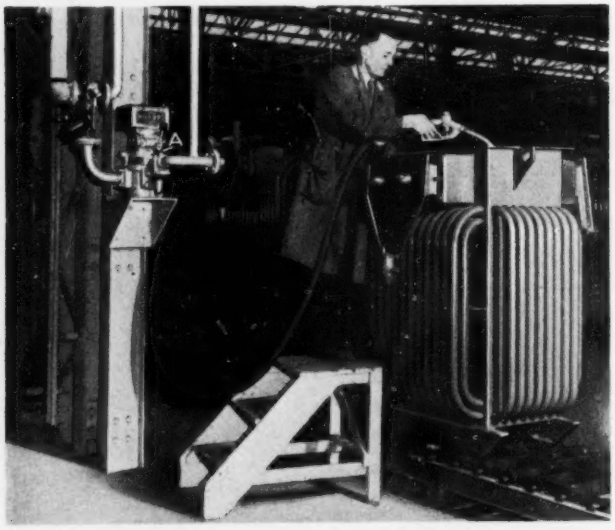


Fig. 8. Filling a Transformer Tank with Heated Oil from a Wayne Metering Pump

ELECTRICAL TESTING AND DESPATCH

Small and medium-size transformers are moved forward along the roller conveyor system to the final test enclosure, seen in Fig. 9, in which two test stations are provided. The roller conveyors of the two stations extend through sliding doors, on the right, to meet the incoming conveyors carrying the transformers to be tested. Between the two conveyor systems there are transverse floor rails, along which runs a motor-driven, pedestrian-controlled bogie, with a roller top. This bogie enables transformers from any of the incoming conveyors to be transferred into either test section. All the tests can be performed rapidly with remote control by push buttons and switches. The associated electrical machines and auto-regulator transformers are located in an adjacent section of the building, away from the production lines.

After they have been tested, the transformers are moved out of the sec-

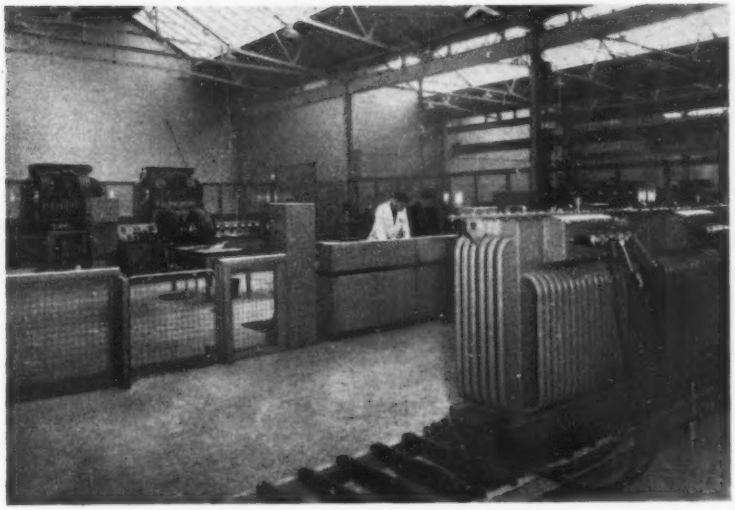


Fig. 9. A View of the Final Electrical Test Enclosure for Transformers

tion, towards the left in Fig. 9, on the conveyors, which meet a second set of transverse floor rails, with a similar pedestrian-controlled power bogie. By means of this bogie, the transformers are transferred on to any one of four roller conveyors in a final preparation bay. The latter is adjacent to the packing and despatch section, seen in Fig. 1, which is served by a 10-ton overhead crane. The entire roller conveyor system and the power bogies were supplied by Paterson Hughes Engineering Co., Ltd.

For the larger transformers, which are assembled and filled with oil in a pit, as previously explained, a somewhat different procedure has been adopted. To minimize the amount of handling required, the transformer is lifted by crane on to a heavy bogie, which runs along rails extending through the test bay and final preparation section to despatch. To avoid interference with the main production flow, a separate test enclosure is provided for carrying out extended tests on transformers, as part of a vigorous programme of research and development.

LOCK WOUND CORES

In connection with research and development, reference may be made to the lock-wound type of core which Ferranti, Ltd., have introduced particularly for the small, single-phase transformers employed in rural electrification. In such distribution systems, because of the low load factors often encountered, core losses have an appreciable effect on electrical efficiency.

The lock wound core has been developed to enable full advantage to be taken of the cold-reduced, grain-orientated electrical steels that are now available in this country. In such steels, the crystal lattices are so arranged that their axes of easiest magnetization are very nearly parallel, and aligned with the direction of rolling. The specific losses in the direction of rolling are therefore much lower than for hot-rolled steels, and there is a corresponding reduction in the magnetizing current required. In a conventional interlocked core, a considerable proportion of the flux flows transversely to the preferred direction, and the numerous joints, if they do not butt, may be a further source of loss. These disadvantages are overcome by the

Fig. 10. A Ferranti Lock-wound Core and Coil Assembly

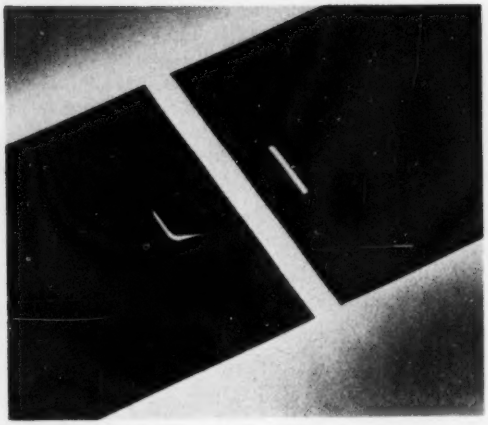


Fig. 11. Lock-wound Laminations are Connected Together by Means of a Tongue and Slot, as Here Shown

lock wound construction, and it is stated that iron losses are reduced by 25 to 30 per cent, and the magnetizing current by some 75 per cent. There is also a reduction of about 10 per cent in the weight of the core.

A typical lock-wound coil and core assembly is shown in Fig. 10. Each lamination consists of a length of core steel which has a slot at one end and a tongue at the other, as indicated in Fig. 11, and the core is wound on a mandrel to a circular form initially. On the winding machine, the laminations are fed through a pair of tension rolls mounted in front of the power-driven mandrel, the tongue at one end of a new strip being engaged with the slot in the end of the strip which is about to pass through the rolls. The latter then serve to flatten the tongue so that the laminations lie closely together on the core. Different widths of lamination strip are used, so as to produce a core with a stepped cross section approximating to a circle, and each lamination forms about two turns of the core. Care is taken in determining the strip lengths to ensure that there is no build up in the core due to coincidence of joints. Lap joints instead of butt joints are thus formed, which reduce electrical losses, and the efficiency is further improved because of the small number of joints. In a conventional transformer of 15 kVA., 11 kV., for example, there are about 1,000 core plate joints, whereas for the lock-wound design there are only 146.

When winding has been completed, a steel retaining band is placed round the core periphery and the mandrel is removed. Shaping of the core to an oblong form, with radiused corners, as seen in Fig. 10, is then carried out on a power-driven machine, specially designed for this purpose. This machine is shown in Fig. 12. Initial location for the core on the horizontal table of the machine is provided by the bar members *A* and *B*, which are attached to round guide rods and are moved inwards by springs, to a position that is determined by nuts on threaded stop rods *C*. Drive to the operating mechanism is taken through a P.I.V. gear which provides steplessly-variable speeds.

When the motor start button is depressed, two side jaws *D* and *E*, pivoted at their lower ends, are moved inwards by right- and left-hand screws, and, simultaneously, two inner jaws *F*

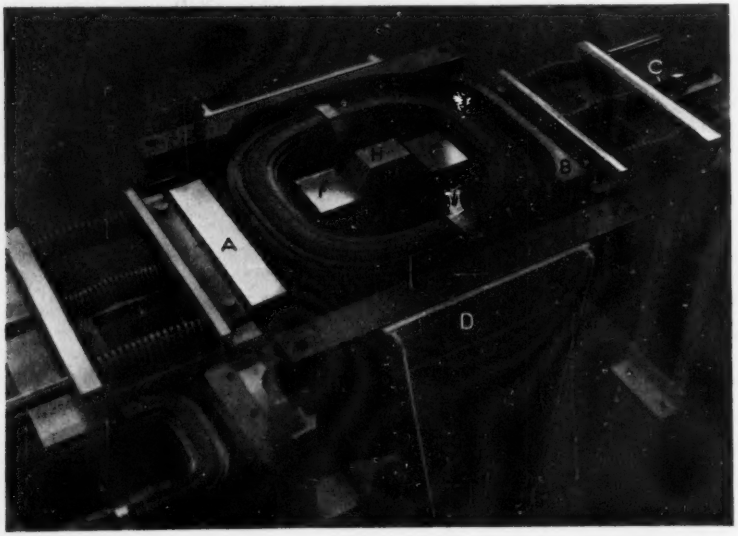


Fig. 12. View, from Above, of the Machine which Forms the Lock-wound Core to a Rectangular Shape

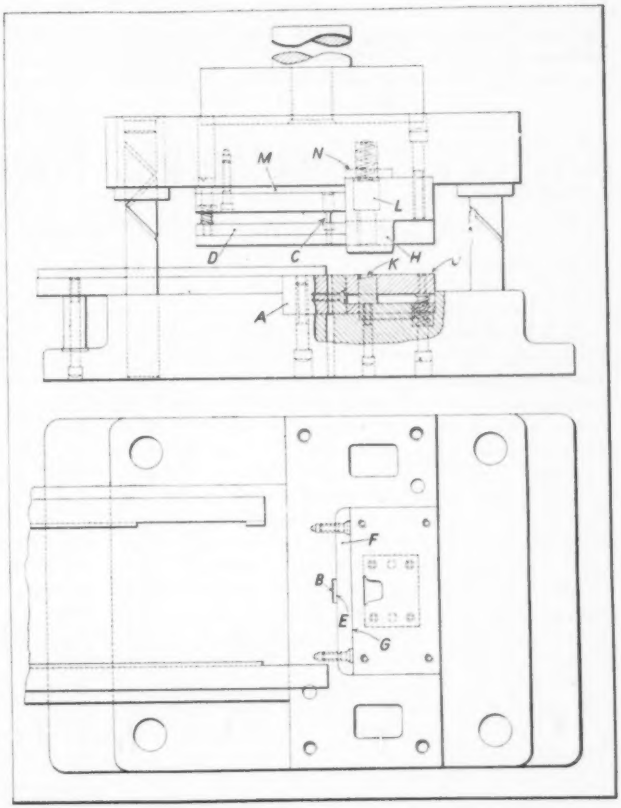


Fig. 13. Details of the Press Tool for Piercing, Shearing, and Cropping the Lamination Strips

and G are urged outwards by means of a centre wedge *H*, which moves upwards. The wedge is operated from beneath by a plate cam, which is driven by roller chain and sprockets from a shaft in the driving train for the right- and left-hand screws. Incorporated in the chain wheel on the cam shaft is a spring-loaded friction disc, which enables the drive to slip when a predetermined expanding pressure is applied to the core by the inner jaws. The outer jaws, however, which are positively driven, continue to move inwards, and when the core has been compressed sideways by a sufficient amount, the drive to the inner jaws is taken up again. With this follow-up arrangement, cores of the required uniform shape are obtained. At the present time, the driving motor is cut off manually by push button when the core has been formed, but to expedite production, also to safeguard the machine against overload, an automatic trip switch is to be fitted.

The formed core is next high-temperature annealed in a reducing atmosphere, to relieve the stresses resulting from the previous winding and pressing operations, and to set it in the required final shape. Subsequently, the core is dismantled into its component laminations, and the latter are laced through the transformer coils, and hooked one to another, until the complete core has been reassembled. At this stage the inside lamination is assembled first, and a steel retaining band is attached finally round the periphery. Insulation strips are fitted to hold the coils in the correct position.

MAKING THE LAMINATIONS

The 0·014 in. thick, grain-orientated steel used for the laminations is supplied by the Steel Company of Wales in continuous 30-in. wide coils, and it is gang-slit at the Hollinwood works into the various widths required. Laminations are then produced from these various coils on a Hordern, Mason & Edwards L40 geared, adjustable-stroke, press of 40 tons capacity.

The drawing, Fig. 13, gives some details of the press tool, which is designed to pierce, shear and crop the strip. Self-centralising, adjustable side guides are provided, at the inlet end, on the bolster of the pillar die set, and a take-off stacking mechanism is to be installed instead of an existing trough, to receive the cut strips.

Referring to the drawing, the die block *A*, which is located in a transverse tenon groove in the bolster, has a piercing aperture at *B* for the rectangular slot in the end of the lamination, and the associated punch *C* is fitted with a spring-loaded stripper plate *D*. The edge *E* of the rectangular die aperture is formed by a separate insert *F*, which is located in a vertical slot and is fastened to the main die block by two screws. The outer face, *G*, of the insert serves as a shearing edge for the cropping punch *H*, and support for the material is provided by a spring-loaded stripper plate *J*. The shearing operation to produce the tongue in the strip is performed by the punch insert *K*, which is fastened by screws and dowels

in a recess in the bolster, and the associated die aperture in the cropping punch block *H* is fitted with a spring-loaded pressure pad *L*. Support for the cropping punch against tilting is provided by two solid rectangular extensions, which enter guide holes in the die block. Hardened steel backing plates *M* and *N* are fitted for the slot piercing punch and the pressure pad.

Engineering Translations

A Branch of Work in which an Error may be Costly

By a Correspondent

It is unfortunate that, in spite of general belief, powerfully reinforced by the personal experience of every "conducted" tourist, that everyone speaks English, there are still many millions of people who out of ignorance, laziness, or sheer perversity, prefer to use their own languages for business purposes. This selfish attitude is apt to cause difficulties for the British manufacturer by forcing him to pay for translations, and even more serious expense may be incurred in putting right misunderstandings which have been caused by such "translations." How serious these misunderstandings can be, was strikingly demonstrated a year or two ago in connection with a merchant transaction over the disputed meaning of the French word "*feveroles*" (a kind of bean), which resulted in one appeal to arbitration, and three actions at law in two countries, over material alleged to have been wrongly supplied.

The writer was once called upon to investigate an incident which was similar in many respects, excepting that the matter did not reach the courts. This misunderstanding also turned upon a mistranslation of a single word, which appeared in a straightforward French order from an old customer calling for "a complete set of spare *segments*" for a large steam hammer. Apparently the translator employed, either by simple guesswork or by the assistance of a pocket dictionary, had decided that the word "*segments*" meant "parts," so that the order, which was for a complete set of spare piston rings, valued at a few shillings, was executed for a complete set of spare parts, and as there seemed to be no need for the exercise of economy in the execution of an open order of this description, the spares supplied were extremely lavish. The upshot was the immediate return of the documents, as soon as these were received by the customer, and the final return of the whole of the material, some of which had been specially manufactured, the total expense to the manufacturer amounting to some £200.

A certain amount of bewilderment was caused in a Spanish engineering works over the real meaning of the Spanish word "*pulgada*" (an English measurement equivalent to 25·4 mm.), which appeared on one of the electrical starters on a large English grinding machine, although it was found, by experiment, that this starter did no more than impart a temporary rotation to one of the small motors.

The true explanation was only discovered after a considerable amount of trouble. Apparently the electrical manufacturer had sent out for translation a series of small indicator plates, including one bearing the single word "inch," but without giving the translator (who, in any case, had no knowledge whatever of the details of the matter) the necessary explanation that this word was not a *noun* indicating an English measurement, but a *verb* with the meaning of "to jog," or "to impart a momentary rotation or movement to a machine or motor." As a result, the translator had quite naturally rendered it by a word meaning a measurement of 25·4 mm.

In such instances, one is usually apt to place most of the blame on the translator, especially if an outsider is employed, and, indeed, such an individual is often somewhat at fault in that he fails to specify in his advertisements his particular field of experience. In the general term "technical translator," the first word would be understood by the machine-tool man to cover his own industry, but a scientist concerned with electronics would probably interpret it as relating to this latter subject.

Undoubtedly, the ideal method of obtaining a competent translation is by joint consultation between the expert on his machine, possibly aided by some knowledge of the language on his own part, and the translator who brings to bear on the subject an intimate acquaintance with the language, assisted preferably by some personal knowledge of the industry for which he is called upon to work.

At the same time, however, it must be borne in

mind that the rate for the work is only about two guineas per thousand words, so that the amount of time which could economically be devoted to an argument over the exact shade of meaning of a single word would necessarily be extremely limited! Thus, as long as the present somewhat haphazard method of selection and low remuneration continue to operate, we shall have to restrain our exasperation over mistakes, and do our best to take the proper action, as, for example, upon receipt of a communication in French, which (according to the translator) meant:

"We have seen in the 'Indicateur' an article on the rectification to which a working done by your firm is mentioned. Could you please send us a piece of this work done, and tell us the cost of same."

Although it would never be guessed from the foregoing, the original letter, in French, was perfectly clear in every respect, and was merely a request for a copy of a treatise on grinding practice, which had been published by the firm some few years earlier.

THE ROBOT

After a few experiences of this kind, the non-linguistic executive might come to pin his hopes for the future on the electronic computing machine—the "electronic brain" of the popular press—especially as, according to recent information, such a machine is expected ultimately to be capable of translating at the rate of 3,000 words per hour. Judging from a recently published example, however, even this system is not without its drawbacks. For instance, a scientific statement in French is as follows:

"Il n'est pas étonnant de constater que les hormones de croissance agissent sur certaines espèces, alors qu'elles sont inopérantes sur d'autres, si l'on songe à la grande spécificité de ces substances."

The equivalent, as typed out by the machine, is:

"Not is not/step astonish of establish that/which? hormone of growth act on certain species, then that/which? not operate on of other if one dream/consider to great specificity of those substance."

Finally, as corrected by the specialist in the subject, we have:

"It is not surprising to learn that growth hormones may act on certain species while having no effect on others, when one remembers the narrow specificity of these substances."

One can, therefore, only agree wholeheartedly with the modest statement of a scientist, working in this electronic field, that it will (apparently) be some years before the language of Goethe can be reproduced by this means in the language of Wordsworth.

THE PANEL

The establishment of panels of thoroughly experienced technical translators, for clearly defined branches of industry, could, with advantage, be undertaken for their members by the numerous trade associations which exist for the purpose of assisting industry, and it may seem strange at first sight that so little has been done in this connection. Some explanation for this apparent neglect may be found in the degree of specialization which is necessary if the matter is to be tackled adequately. It will readily be appreciated that whereas a good committee man or a competent public relations officer could readily put out many thousands of words of sound argument and good advice on such subjects as better salesmanship, quick deliveries, provision of spares, importance of price maintenance, and so on, without having to acquire any closer knowledge of the subject than can be gathered from the daily perusal of the popular press, any examination of the qualifications of a technical translator, or any discussion of the merits or shortcomings of his work, necessitates an acquaintance with the details of the subject which is not to be acquired overnight. The absence of such familiarity, moreover, would soon make itself embarrassingly apparent.

NEW SURFORM FILES AND PLANES.—Four new tools have been added to the Surform range produced by Simmonds Aerocessories, Ltd., Treforest, Glamorgan, all of which incorporate the distinctive, perforated blades, developed and supplied by Firth Brown Tools, Ltd.

The No. 111 block plane has a fine-cut blade, and is intended for one-handed application for smoothing edges and small surface-areas, particularly where access is restricted. Another tool, known as the No. 102 fine-cut file, is claimed to permit smooth, clean cutting of mild steel and other tough material. There is also a No. 105, fine-cut convex plane for spot trimming and smoothing metal motor-car bodies, and similar applications. The fourth item is the No. 103 half-round file for use on concave surfaces.

The Surform blade gives controlled depth of cut with the minimum of pressure. Cuttings pass through the blade so that clogging does not occur, even when the surfaces of plastics materials that may soften through frictional heat are being worked.

High-speed Cutting of Drawn and Extruded Sections

At the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd., the control and development of all applications of cutting tools and machine tools, throughout the various manufacturing departments, is carried out from a centralized rates and methods section. Important among the activities of this section is investigation into the most suitable techniques for the use of tungsten carbide tools, and some notable results have been achieved. Attention has already been drawn in MACHINERY, 91/552—6/9/57, to the gun drill reamers developed by the company some years ago, which are now being made in a range of sizes by William Jessop & Sons, Ltd., Brightside Works, Sheffield.

Another outstanding example is afforded by the methods employed for cutting off brass, copper, and light-alloy drawn and extruded sections, which are required in a variety of shapes and sizes for the production of contacts and other switchgear components. Typical sections are shown in Fig. 1, the section at A, which is of copper, having an overall width of 5¾ in. For the initial operation of cutting the material into short lengths, a Rowland type AHC hydraulic-feed, cutting-off machine has been adapted by fitting a Firth-Brown Mitia tungsten-carbide-tipped saw in place of an abrasive wheel, and providing an automatically-retracting work stop.

Previously the operation was carried out on conventional horizontal milling machines, using high-speed steel milling cutters set up in gangs for cutting off several pieces at once. Four machines were employed, each tended by an operator, to maintain the required output, and the cutters required to be re-sharpened very frequently, particularly when handling copper. With the one Rowland machine now installed, the required output can easily be maintained.

The machine is of the swinging arm type, and the spindle driving motor, of 20 h.p., is carried at the rear of the counterbalanced arm, together with a hydraulic cylinder for the feed and rapid return motions. Preloaded ball and roller bearings are provided for the spindle, and the drive is taken from the motor by six V-belts to a quill-mounted pulley, so that the spindle is relieved of all belt pull. A close-up view from the left-hand, driving end of the spindle is given in Fig. 2, and from the right-hand side in Fig. 3, where the Mitia tungsten carbide tipped saw, of 16 in. diameter, can be seen at *A*. The downward and return movements of the saw arm are limited by adjustable stop nuts on the screw *B*, Fig. 2, which is pivoted at the lower end on the machine base.

The bar to be cut, seen at *C*, is supported on a roller guide stand, and is fed by hand up to the adjustable end stop *D*, which is carried on a rocking bar *E*. The latter is coupled to the spindle arm by a linkage at the left-hand

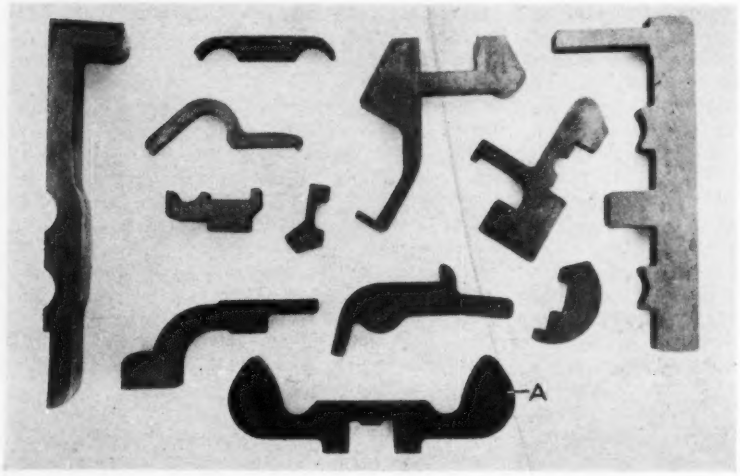


Fig. 1. Typical Brass and Copper Sections Used in the Manufacture of Switchgear

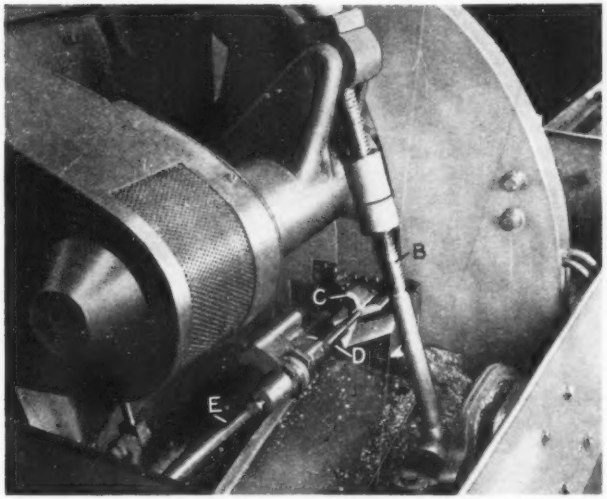


Fig. 2. Close-up View of the Rowland High-speed Cutting-off Machine, from the Left of the Spindle Head

end, whereby the stop is retracted automatically, after the section material has been gripped in the hydraulic vice, but before the saw starts to cut. In this manner, back cutting is prevented during the return stroke of the saw blade, so that the workpieces are cut accurately to length, and with a good surface finish on the sawn faces.

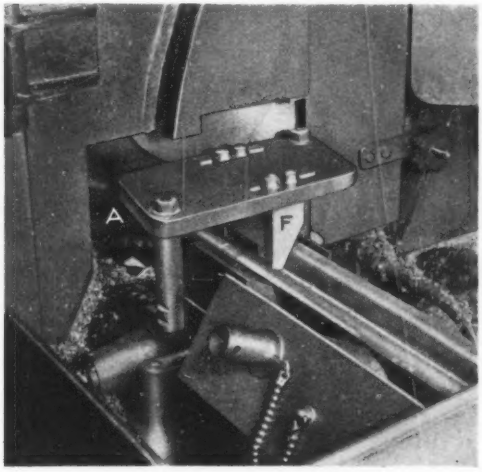


Fig. 3. The Hydraulic Vice on the Rowland Cutting-off Machine

The vice jaws, profiled to suit the section, can readily be changed, and the upper jaw *F*, Fig. 3, is carried on a bridge plate attached to two vertical bars, which are coupled to a hydraulic clamping cylinder in the bed. Upward travel of the jaw *F*, for unclamping, is reduced to a minimum by the action of a spring-loaded detent which engages one of a series of saw-tooth notches in the front pillar. A single lever at the front of the machine controls, in an interlocked sequence, the closing and opening of the vice jaws and the feed and return movements of the saw spindle arm.

The saw blade used for copper differs from that for brass as regards both tooth form and number of teeth, and some details of the saws that have been found to give the best results are given in Fig. 4. In each case, the cutting width is 0·145

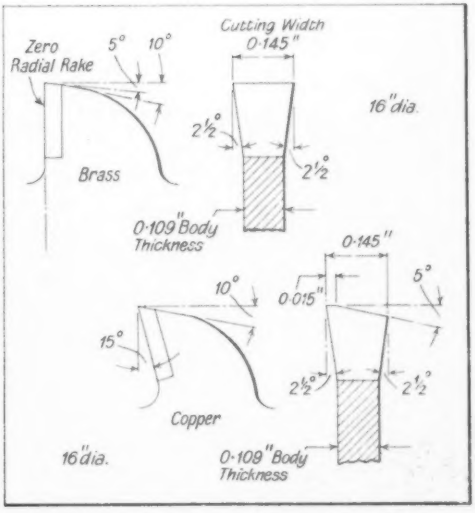


Fig. 4. Details of the Teeth Used for Cutting Brass, Copper and Light-alloy Sections

in. and the side clearance angle 2½ deg., but for brass there are 42 straight-topped teeth with zero radial rake, a 5 deg. cutting land, and a 10 deg. secondary clearance. On the saw for copper, which has only 36 teeth, the teeth are bevelled

5 deg. on the top, staggered right- and left-hand, the radial rake is 15 deg., and the top clearance angle is 10 deg.

A cutting speed of 7,000 ft. per min. is employed, and very high feed rates, for example up to 20 in. per min., can be used for brass, depending upon the size of the section. The 5⅛ in. wide copper section seen at *A*, Fig. 1, can be cut in 14 sec., and a saw will run for 1½ to 2 days, cutting up to 6,000 pieces, before it requires resharpening. The pieces can be produced parallel within 0·001 in., and without burrs, and a tolerance of 0·005 in. on length can readily be maintained, at high feed rates.

It has been found that if the feed is reduced somewhat, cutting can be carried out to an accuracy of 0·002 in. For light alloy sections, which are also cut on the machine, the same saw as for copper is used, and soluble oil coolant is employed for all materials.

Method of Making Contoured Master Tubes

A new method of making contoured master tubes for aircraft gas turbines is being employed by the Aircraft Engine Division, Ford Motor Co., Chicago, Ill., U.S.A. This so-called "erector set" method, developed by the Semi-Production and Quality Control Departments, has enabled the output of master tubes to be doubled for the same number of personnel and floor space, and has resulted in substantial savings in production costs being effected.

For this method, a drilled and tapped surface plate is employed, which has straightedges along all four sides. Vertical locating pillars are accurately positioned (wherever a bend in the master tube is specified) by placing gauge-blocks between the straightedges and the square, ground bases of the pillars, as indicated in Fig. 1. The pillars are clamped in position by straps which are held down by screws.

Collars, each having two diametrically opposed V-block surfaces, are positioned vertically on the pillars by means of a vernier height gauge. Setscrews are provided which are tightened against flat surfaces on the pillars to clamp the collars in position. Some of the pillars have swivel tops for use when compound angles are specified for the tube-contour checking masters.

Tooling balls are then positioned in the V-blocks, and straight sections of steel tubing are placed between the balls to represent a continuous tube. Finally, all components of the tube assembly are cemented together with a strong adhesive. When the cement has set, the master is removed from the uprights. Locations and spacing between the tube bends are held within 10 per cent of the specified tolerances for production tubes.

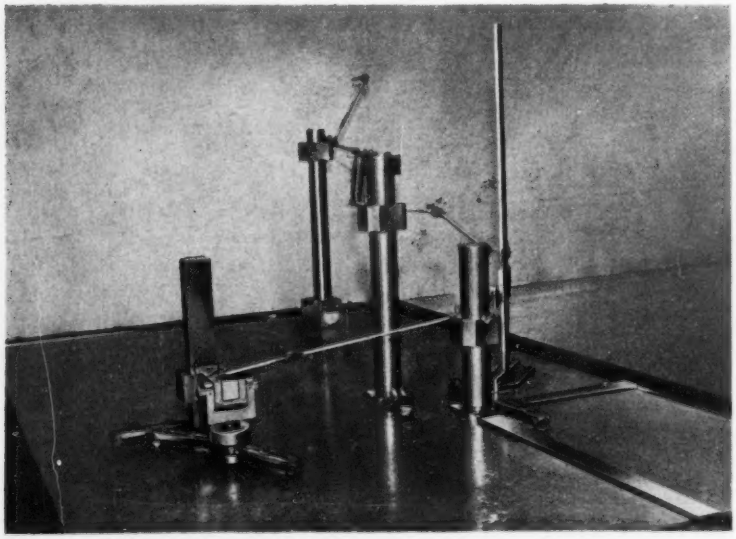


Fig. 1. A Drilled and Tapped Surface Plate, Provided with Straightedges on All Four Sides, is Used to Locate Pillars for Making Masters for Tube Contour Checking

It has been estimated that this method permits a saving of 60 per cent in the man-hours required. In addition, less operator skill is necessary, greater accuracy can be maintained, inspection time is greatly reduced, and masters are

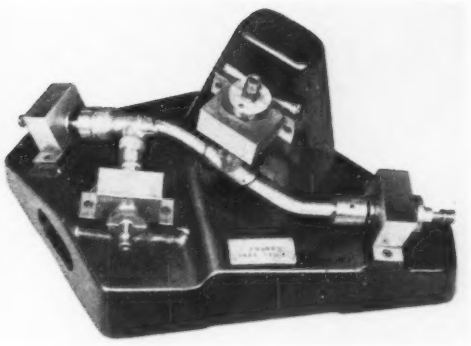


Fig. 2. A Typical Working Gauge for Checking the Contour of a Bent Tube is Made, with the Aid of a Master, from Laminated Lightweight Fibre-glass Cloth Impregnated with Epoxy Resin

not affected by stresses. One other important advantage is that existing master tubes can be quickly modified if designs are changed.

The tube-contour masters are employed in the production of working gauges from laminated light-weight fibre-glass cloth impregnated with epoxy resin. A typical production tube-checking gauge is shown in Fig. 2. Gauges formerly employed, which were made from steel or cast phenolic materials, were more expensive, were affected by temperature changes, and were less resistant to wear during service.

New Solar Furnace

The solar furnace shown in the illustration has recently been constructed by the Stanford Research Institute, California, U.S.A. A polished aluminium paraboloid mirror is mounted 32 ft. above the ground and facing downwards. The flat mirror, installed at the foot of the tower, serves to reflect the sun's rays on to the paraboloid. This flat mirror, which is known as a heliostat, is made up of nine back-silvered sections, and is mounted in a cradle.

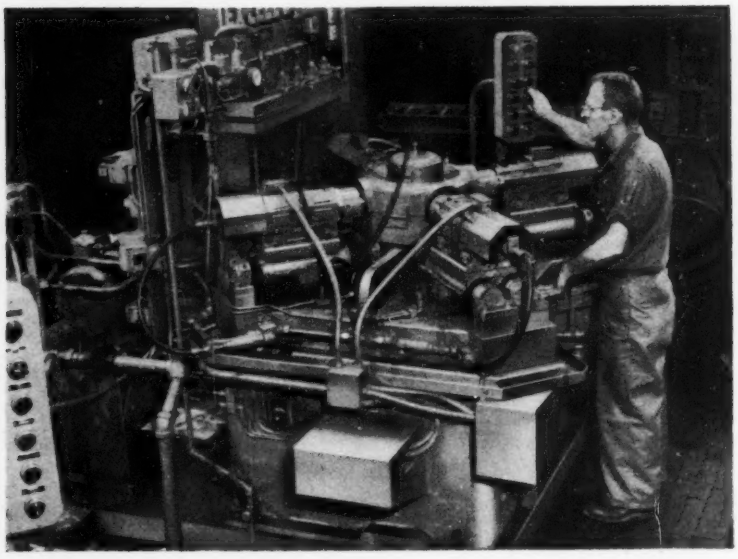
A control system turns the cradle assembly at such a rate that the mirror follows the sun and constantly directs the rays on to the paraboloid. The advantage of this arrangement is that the paraboloid and target remain stationary, with the specimen or crucible facing upwards. It is stated that the introduction of the second mirror results in a heat loss of only 200 to 300 deg. F.

The target on which the paraboloid is focused consists of a plate at the end of a retractable framework. Attached to the framework there is a shield which can be swung over so that the heat is applied or shut off from the specimen. Within the focal spot of ¾ in. diameter a temperature of the order of 6,000 deg. F. is obtained, and it is stated that the "pure" heating provided avoids contamination of the specimen. Because the "hot-spot" is sharply defined, a steep temperature gradient is obtained, and at a point 1 in. from the centre of the spot the value is less than 3,000 deg. F.

Such a furnace is particularly suitable for the production of materials of a very high standard of purity, as required, for example in connection with transistor research. Melting can be confined to a limited area so that contamination from a crucible is avoided.

Another furnace application is concerned with the effects of thermal shock on ceramics and other materials. A chilled specimen can be placed on the target plate under the moveable shield, and when the latter is suddenly withdrawn, the specimen is exposed instantly to the full furnace temperature.

Solar Furnace Constructed by the Stanford Research Institute, U.S.A. The Flat Mirror Follows the Sun, and the Paraboloid and Target Remain Stationary



Some Equipment Employed for Machining Dynaflow Transmission Components

One production line at the works of the Buick Motor Division of General Motors Corporation, U.S.A., for gears for the new Flight Pitch Dynaflow transmission, was the subject of an article in MACHINERY, 92/368—14/2/58. Other interesting equipment employed in the manufacture of these transmissions is described here.

Variable-pitch stator vanes are mounted radially between a front and a rear carrier ring. This split construction, which is necessary to permit assembly, complicates manufacture because the centre lines of the vane-shaft holes must be accurately located on the joint line between the front and rear carriers.

Both the front and rear carriers are made from cast iron. They are cast to close tolerances in shell moulds, so that rough-machining is not necessary and the amount of stock to be removed in semi-finish and finish machining is reduced. Matched pairs of the front and rear carriers are assembled with washers and "clutch-head" screws.

With previous designs of Dynaflow transmission, the 20 equally-spaced, vane-shaft holes in each carrier assembly were drilled first and then bored. For the new transmission, the holes are completed at one operation on Ex-Cell-O 4-way, precision boring machines, one of which is seen in the heading illustration. Each machine is set up to Bor-Dril four holes at a time, and the work is indexed four times during the complete cycle.

In conventional gun-drilling, the drill is stationary and the work is rotated at a comparatively slow speed. With the Bor-Dril process, the work is clamped in a simple fixture instead of a chuck, since it is not rotated. For this particular operation, the carbide-tipped gun drills are rotated at 7,200 r.p.m. by means of 120-cycle motorized spindles to provide a speed of 295 ft. per min.

The gun drills are hydraulically actuated and cam fed to complete four holes (⅞ in. deep) in 11 sec. Retraction of the tools, and hydraulically-operated automatic indexing, requires 4 sec., so that the cycle time is 15 sec., and a part is completed every 75 sec.

Hole size is held to 0·1585 in. ±0·001 in. Carrier assemblies are loaded manually into the fixture and are clamped by air. High-pressure coolant is directed through the gun drills to force the chips out by way of a single flute, and to carry away heat. In the close-up view of the Bor-Dril machine given in Fig. 1, the splash guard has been swung back to show the tooling area, and a com-

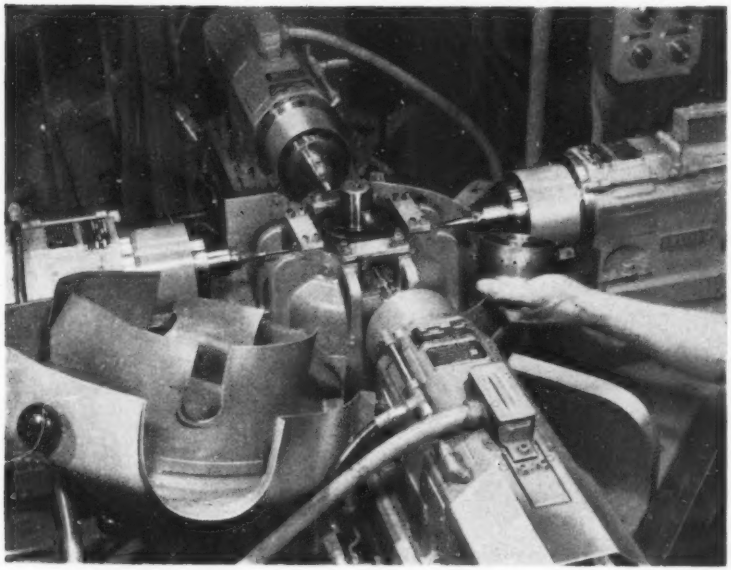


Fig. 1. Close-up View of the Machine Employed for Bore-Drilling 20 Vane-shaft Holes in Carrier Assemblies

pleted stator-blade carrier assembly is seen in the operator's hands. Radial disposition of the vane-shaft holes, and their angular positions in relation to the centre lines of dowel holes in the assemblies, are inspected periodically by means of a Kodak contour projector.

Discs and hubs for the first turbine converter of the Flight Pitch transmission are mechanically assembled and welded on the special 10-station transfer machine shown in Fig. 2, made by the Expert Welding Machine Co. The discs, of approximately 11½ in. diameter, are stacked vertically in the magazine-type feeding unit, seen at the left, while the hubs, of 1⅞ in. diameter by 1⅞ in. long, are hopper fed down a chute.

At the loading station, a press ram pushes each disc on to a hub. A reciprocating shuttle bar then slides the pressed assembly along transfer rails to the second station, which is idle. When the assembly has been transferred to the third station, seen at the left in Fig. 3, the areas on the disc face and hub periphery which are to be welded are preheated by means of 60-cycle induction units.

Submerged arc welding is performed at station (4) (centre in Fig. 3), with a Lincoln LAF-3 head which is automatically lowered into position, while three spring-loaded rollers are pressed against the disc. Power for the welding head is supplied from a 600-amp. capacity D.C. generator, and the work-holding fixture is rotated while welding is in progress. Welding is performed at 400 amp. and 26 volts, with $\frac{3}{32}$-in. diameter wire. A vacuum

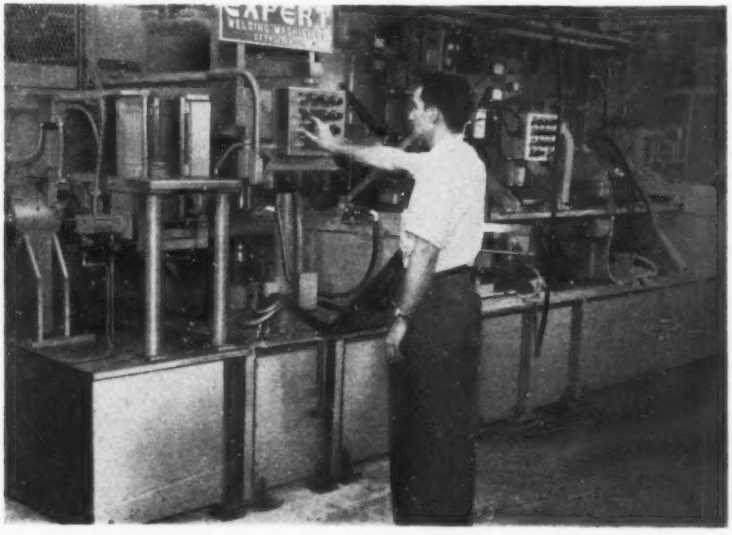


Fig. 2. Ten-station Transfer Machine for Assembling Discs and Hubs for the First Turbine Converters

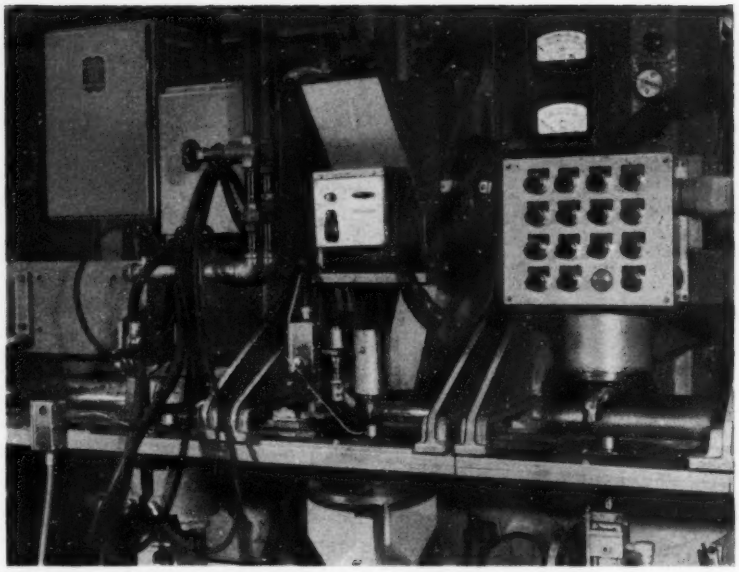


Fig. 3. At Station (4) the Hub is Joined to the Disc by Submerged Arc Welding After the Assembly has been Preheated by Induction at the Preceding Station

pick-up nozzle at station (5), seen at the right, removes unused flux from the assembly.

The weld area of the disc-and-hub assembly is cooled by forced air at station (6), and post-heated by means of induction units at the seventh station to temper hard areas and prevent cracking. Stations (8) and (9) are idle to permit slow cooling of the assembly. At the ninth station, an impact hammer, with an annular pointed tool, is applied to loosen the scale from the weld area. Assemblies are automatically unloaded at the tenth station.

Front-inner and rear-outer races for the free-wheel units of the Flight Pitch transmission are made from SAE 4063 steel. Bearing surfaces on the races are flame-hardened to a minimum of 60 Rockwell C., for a depth of 0·050 in. and a width of 0·650 in. on Cincinnati Flamatic machines. The 2-station set-up for flame-hardening the roller-bearing surfaces on the free-wheel outer races is shown in Fig. 4.

Each race is held on an arbor and rotated while it is being heated by flames. At present, a Ray-O-Tube temperature indicator is employed to extinguish the flames automatically when the bearing surfaces reach a temperature of approximately 1,500 deg. F., which requires about 30 sec. It is intended, however, to substitute a timer mechanism for this system. Heated parts drop from the arbor into an oil quench tank and are removed by

Fig. 4. Two-station Set-up for Flame Hardening Bearing Surfaces on Free-wheel Outer Races

Fig. 5. Rotating Cup Type Abrasive Wheels are Applied to Superfinish the Faces of Disc-and-hub Assemblies, to 15 micro-inches

a wire mesh conveyor at the right of the machines. About 240 races can be selectively hardened per hour at 70 per cent efficiency.

A considerable amount of Superfinishing is performed on various components of the transmission, to improve the finish and geometry of different surfaces. Also, in many cases, this treatment assists the retention of lubricant on the surfaces so that seal, gland, or bearing wear is reduced. Two applications of Superfinishing, to the disc-and-hub assemblies for first turbine converters, are shown in Fig. 5 and 6.

The equipment seen in Fig. 5 is employed for Superfinishing the hub faces of the assemblies by means of rotating, cup-type abrasive wheels of 1½ in. diameter. The wheels are made from virtified bond, silicon-carbide abrasive of 320 grain size. Each station of this Gisholt 2-spindle vertical Superfinishing machine is equipped with a work-centralizing, locating, and driving fixture, the work being rotated during the operating cycle by means of a gear-driven platen. Simultaneously, the Superfinishing spindles (on which the cup type wheels are mounted) are lowered into position, rotated, and traversed across the work faces.

The abrasive wheels are held against the hub faces under a hydraulic pressure of about 25 lb. per sq. in. A surface finish of 15 micro-inches is obtained on the hub faces which are held square with the axes of the assemblies, within 0·001 in.

Oscillating motion is imparted to the abrasive stones employed to Superfinish the bearing surfaces of the assembly hubs, on the machine shown in Fig. 6. In this instance, the stones are initially dressed to fit the curved surface of the work. Air-operated, draw-back type expanding mandrels are provided to hold the assemblies. The work is rotated fairly slowly (about 50 surface ft. per min.), and the stone, applied under hydraulic pressure, is oscillated at 800 strokes per min.

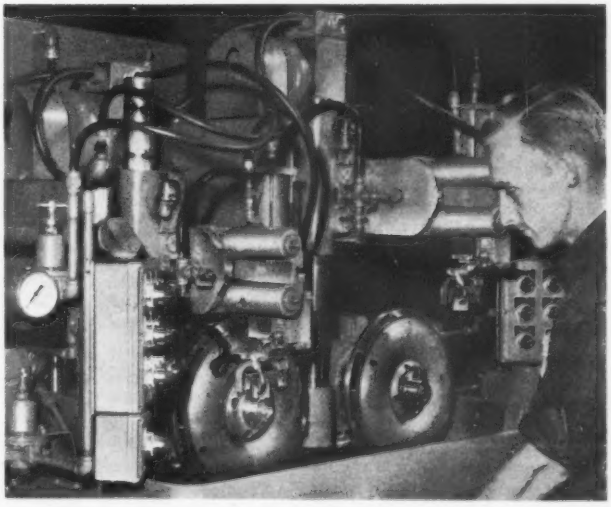


Fig. 6. Set-up for Superfinishing Bearing Surfaces on the Disc-and-hub Assemblies with Oscillating Form-dressed Stones

New Production Equipment

Kitchen & Wade Unit Head Drilling Machines

Kitchen & Wade, Ltd., Arundel Street, Halifax, are building a range of unit heads, with automatic drilling cycles, which can be supplied in this form for users to build-in to equipment of their own construction, or incorporated in machines for drilling in the horizontal, vertical or angular directions. The heads can also be arranged for boring and milling operations.

Three standard sizes are built, with single-spindle drilling capacities in mild steel up to 1, 2 and 3½ in. diameter. The intermediate size has a standard traverse of 12 in. on the base, but heads with traverses of 15 and 18 in. can also be supplied. The main drive is normally provided by a 4-h.p. constant-speed motor, but motors of 3 or 5 h.p. can be fitted for lighter or heavier duty. The spindle centre height, from the lower surface of the base, is 11 in., and the dimensions of the standard baseplate are 36 in. long by 14½ in. wide. Overall dimensions of the standard No. 2 head are 53 in. by 19 in. by 22 in. high. A multi-spindle unit can be applied to the head to cover a maximum drilling area of 12 by 10 in. The approximate weight of this standard head is 10 cwt.

A fully-adjustable automatic cycle provides for rapid advance to the work, drilling at a pre-set feed, and rapid return to the initial position, where the head stops. Nominally, there is one speed and one feed, but pick-off gears are supplied to provide four variations of speed and feed, which can quickly be obtained. The rapid power traverse is driven by a separate small motor, which is so arranged that, when the drilling feed comes into operation, a brake is applied until the machining has been completed. A machined front face is provided on the head for the attachment of a multi-spindle unit, which may have either fixed or adjustable spindle centres. The main spindle nose may be bored Morse taper, or have a stub end for driving a multi-spindle unit.

For the No. 1 unit head the standard traverse is 8 in., with alternatives of 10 or 12 in., and the main drive is by a motor of 1 h.p., or for lighter duty, ½ or ¾ h.p. The spindle centre height from the bottom of the base is 9 in., the overall dimensions of the unit are 42 in. long, 14 in. wide, and 18 in. high, and the weight is 6 cwt. With a multi-spindle unit, the maximum drilling area is 8 by 6 in. The No. 3 unit head has a standard traverse of 12 in., which can be increased, if required, to 18 or 24 in. It is normally driven by a 10-h.p. motor, but a 15-h.p. motor can be fitted for heavier duty. The spindle centre height from the bottom of the base is 15 in., the overall dimensions of the standard unit are 75½ in. long, 28 in. wide and 31 in. high, and the weight is 20 cwt. When a multi-spindle unit is applied to this head, the maximum drilling area is 18 by 15 in.

Fig. 1 shows a No. 2 size head fitted with a milling spindle, which is mounted in the horizontal plane and carried in Timken taper roller bearings. The spindle end has a No. 40 International taper, and a draw-bolt is provided. Fine adjustment of the spindle, through a maximum distance of 3 in.,

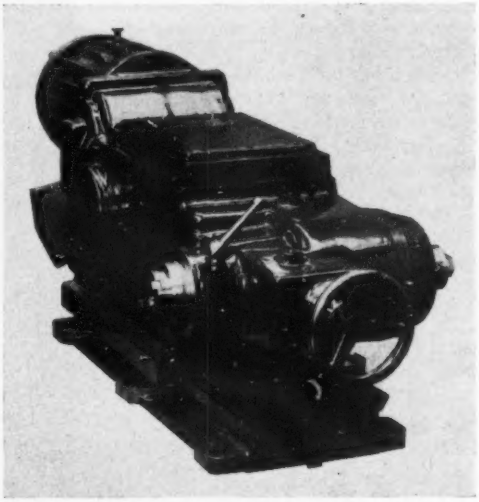


Fig. 1. Kitchen & Wade No. 2 Unit Head Fitted with Milling Spindle

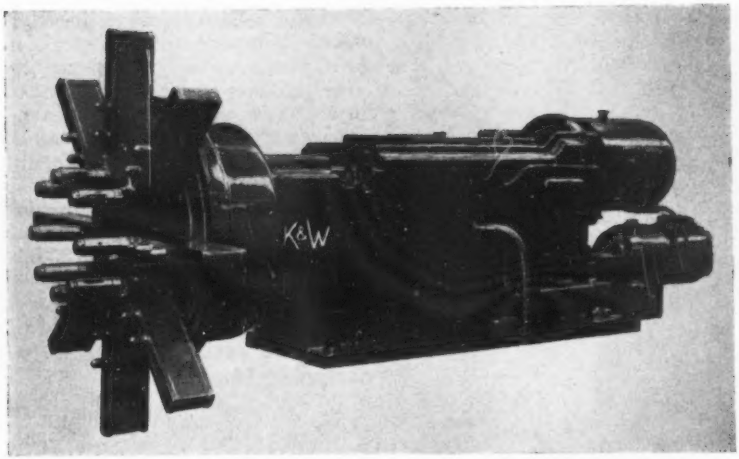


Fig. 2. Kitchen & Wade No. 3 Unit Head with Eight Adjustable-centre Spindles

is obtained by a handwheel fitted with a micrometer dial, and the spindle is clamped by lever.

In Fig. 2 is shown a No. 3 unit head equipped with eight, adjustable-centre, spindles. The maximum pitch circle diameter is 16 in., and the head is designed for drilling ⅞-in. diameter holes in the flanges of cast iron pipes.

Fig. 3 shows a duplex-column machine, with a No. 2 unit head mounted vertically on each column, for drilling the holes in ring spanners. Work-holding fixtures and jigs are provided, and both heads are controlled by one operator. While one head is engaged in drilling, the other fixture is being reloaded.

A duplex horizontal machine, incorporating two No. 2 unit heads, each equipped with a 6-spindle adjustable-centre, drilling unit, for operating on the flanges of commercial vehicle rear axles, was illustrated in MACHINERY, 92/864—11/4/58.

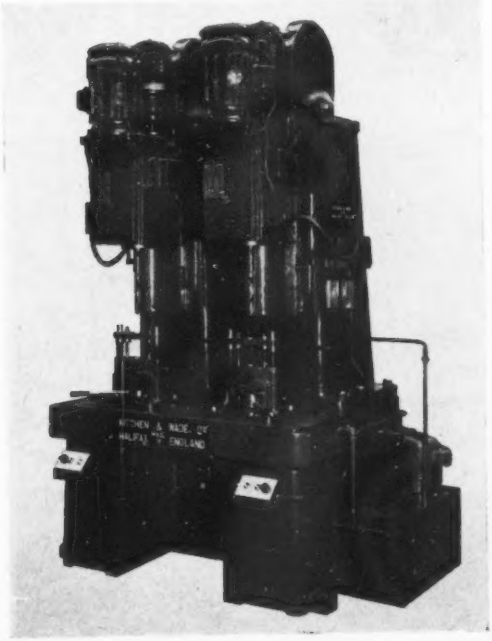


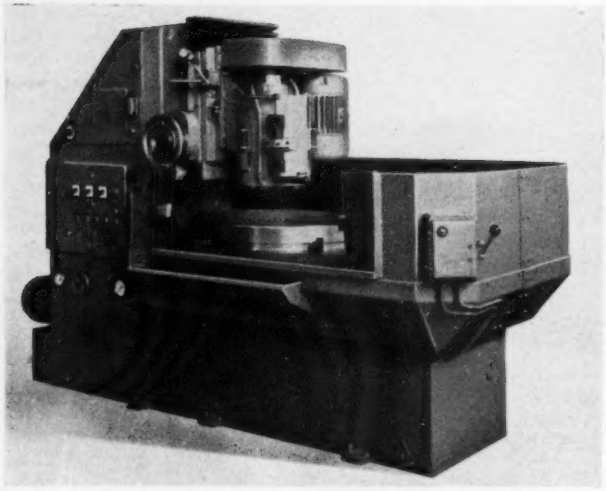
Fig. 3. Kitchen & Wade Duplex Column, Vertical Drilling Machine with No. 2 Unit Heads

Mengele Rotary Table Surface Grinders

Stuart Davis, Ltd., Much Park Street, Coventry, have recently been appointed sole agents in this country for the range of rotary table surface grinders built by Karl Mengele & Söhne, Gunzburg-Donau, Germany. One of these surface grinders is shown in the figure.

A feature of the design is that, during the grinding cycle, the worktable is simultaneously rotated and traversed hydraulically on roller bearing bedways. These combined motions enable a cut to be taken on the entire surface of a large workpiece, of either circular on non-circular shape, during a single revolution, with a wheel of fairly small diameter. For example, six double strokes are applied to the table during one revolution, when grinding is being carried out on a workpiece of 40 in. diameter or on a hexagonal component which can be contained in a circle of the same diameter. If required, strokes of different lengths can be applied to the table during one revolution, for taking a continuous cut on a workpiece of irregular shape. In this way, the cycle time is reduced.

Interchangeable plate-type cams of different shapes can readily be fitted for operating the hydraulic valve which controls the table traverse.



Mengele Rotary Table Surface Grinder

With this arrangement, different numbers and lengths of table strokes for each revolution can be obtained, to suit the shape of the workpiece. Down feed can be applied to the wheelhead by hand, or automatically at the end of each table revolution. An indicator is fitted to facilitate grinding workpieces accurately for thickness, and there is a Peristat dressing attachment whereby the reduction in height of the segment-type wheel, as a result of wear and truing, is indicated.

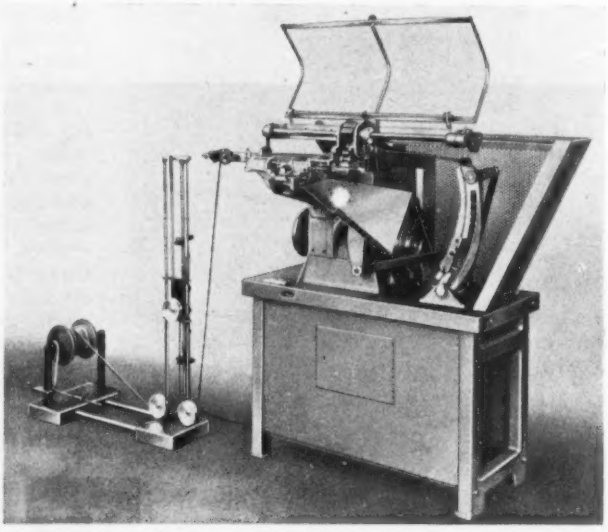
The type PSM surface grinder will handle work up to 13 in. thick, and is fitted with a 35½-in. diameter table which has a travel of 18 in. on the bedways. The steplessly-variable table speeds available range from 1·8 to 8 r.p.m., and the traversing speeds from 19 to 354 in. per min. A 13¾ in. diameter wheel is employed, and the spindle, which runs in adjustable bearings, is driven by a 10/13 h.p. motor.

A similar machine is equipped with a 47½-in. diameter table which has a travel of 24 in. on the bedways. Both machines can be fitted with detachable magnetic chucks. A third grinder in the range has a built-in 40-in. diameter magnetic chuck, and a table travel of 24 in.

A type PSM 1200 DJ machine of 2-column design is also available, which incorporates separate wheelheads for surface grinding, and for grinding bores from 2⅜ to 5½ in. diameter. In addition, the range includes a type PSM 1200 DS machine with two surface grinding heads, one of which is intended for taking roughing, and the other for finishing cuts. The PSM 1200 grinders are equipped with motors of 20 to 25 h.p. for the wheelhead drives.

Avo Wire Cutting and Stripping Machine

In the accompanying illustration is shown a wire cutting and stripping machine which has been introduced by Avo, Ltd., Avocet House, 92-96 Vauxhall Bridge Road, London, S.W.1. Two types can be supplied, designated DA53 and DA53V, and for both the minimum length cut is 1·2 in., and the minimum stripping length 0·16 in. The DA53 machine will cut a maximum length of 14·56 in. with a stripping length of 1·6 in., or 15·35 in. with a stripping length of 0·8 in., and gives an output of 3,000 lengths per hour. On the DA53V machine, a cam can be set to provide for multiple feeding before the wire is cut



Avo Type DA53V Wire Cutting and Stripping Machine

off and the trailing end stripped. In this way, lengths up to 96 in. can be cut, the output rate for this length being 500 pieces per hour.

Drive is taken from a ½-h.p., 1,425-r.p.m. motor with push-button control, and the machine is stopped automatically if the wire supply is exhausted or the wire breaks. The operating cycle is controlled by cams, and a link motion is employed for reciprocating the cutting and stripping head, the length of stroke being accurately adjusted by setting one of the drive links to the required position on an arc-shaped lever. The stripper carriage is carried in adjustable V-guides.

Cable or wire is severed by closing-in opposed notched cutters, and a similar action provides for cutting through the insulation in readiness for stripping. The design of the stripper ensures that the surface of the conductor is not damaged, and an automatically-controlled compressed air jet removes the insulation waste. A wide variety of wires and cables may be handled, of both single- and twin-cored types. To change over from one form of wire to another, the complete stripper holder assembly can readily be removed by releasing four screws.

All moving parts are automatically lubricated. A 5-digit counter is fitted, which provides for switching off the machine automatically when a pre-set number of lengths has been cut. If required, a wire pay-off unit with electrical contacts, and a roll straightener for wire, can be supplied.

Ajax 36-in. Radial Drilling, Boring and Tapping Machine

Ajax Machine Tool Co., Ltd., West Mount Works, Halifax, have recently introduced the AJ35 radial drilling, boring and tapping machine, here illustrated, which has maximum and minimum spindle radii of 36 and 11 in. The drilling capacity is 1¼ in. diameter in mild steel, and ¾-in. diameter Whitworth threads can be tapped.

A working surface of 35 by 26 in. is provided on the T-slotted baseplate, which incorporates a sump, whence the coolant is delivered by a self-contained motor-driven pump.

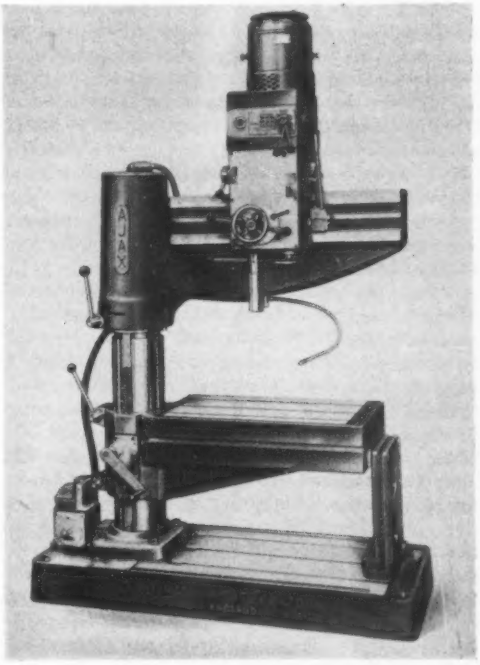
Of 9 in. diameter, the pillar is ground to ensure easy movement of the table. The box-section arm has ample bearing support at the top of the pillar.

Either a swing-aside type table, or a tilting swing-aside table can be fitted. The former is T-slotted on the top and front faces, and the latter on the top face only, and the working areas of the top faces are 30 by 22 in., and 24 by 20 in. respectively. Both types are normally arranged for hand elevation through worm reduction gearing.

Alternatively, power elevation can be provided by a self-contained motor-driven gearbox mounted on the table. Raising and lowering is then controlled by a switch, which is interlocked with the table clamping arrangement.

Of box-type construction, the saddle houses all the spindle mechanism, and is traversed on the arm by handwheel, pinion and rack. The drilling thrust is taken on a vee slide to ensure that the spindle alignment is maintained. Nine spindle speeds are available from 100 to 1,500 r.p.m., and there are three feeds, ranging from 0·005 to 0·015 in. per rev. Drive is taken from a 2-h.p. vertical motor mounted on top of the saddle.

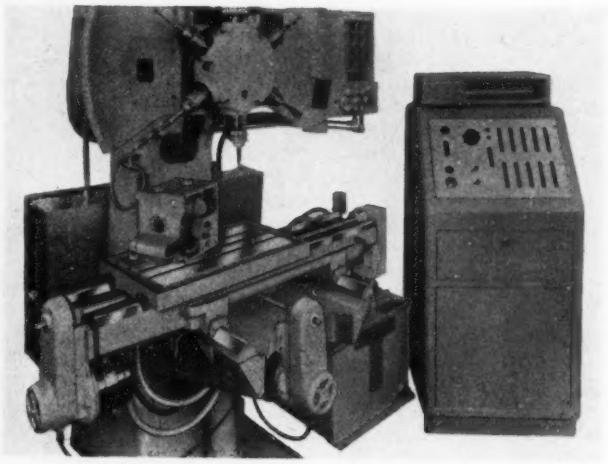
Of high-tensile steel, the spindle is carried in hard phosphor-bronze bearings, the end thrust being taken on ball races. It is 1¾ in. diameter in the driving part and the nose is bored No. 3 Morse taper. In addition to power feed, rapid hand traverse, fine hand feed, and sensitive hand feed are available for the spindle. An automatic tripping mechanism is provided for the power feed. The spindle traverse is 7½ in., and the maximum distance from the spindle to the base is 44 in., and to the table, 26½ in. A lever-operated spindle



Ajax 36-in. Radial Drilling, Boring and Tapping Machine

control switch has forward, reverse and off positions.

The floor area occupied by the baseplate is 62½ by 26½ in., and the clearance circle for the arm is 96 in. diameter. The approximate weight of the machine is 29½ cwt., and the overall height, 94½ in. A similar machine can be supplied, with a 48-in. maximum spindle radius.



Burg Automatic Work Table with Punched-tape Control

Burg Automatic Work Table with Punched-tape Control

An automatic work table with punched-tape control has been introduced by the Burg Tool Manufacturing Co., Inc., Gardena, Calif., U.S.A., for use on the company's Burgmaster turret drilling machine, as shown in the figure. This machine is made in 6- and 8-station types, and there is provision for individual control of speeds, feed rates, hole depths, and rapid approach and return movements of the spindles.

Spindle selection and control, and movements of the table to different positions, are derived from data punched into the tape, and successive operations, such as drilling, tapping, reaming, and boring, can be carried out at each table setting. The equipment can be set to operate on an entirely automatic cycle. Alternatively, if it is desired to check individual operations, it can be arranged that the table and spindle movements take place only when push-buttons are actuated. Instructions can be punched on the tape to stop the cycle at any chosen stage.

When the equipment is set for fully-automatic working, and the starting button is depressed, the tape advances, so that the first set of instructions is brought to the reading unit. Information for moving the longitudinal and cross slides of the table to obtain the first setting is then transmitted, in digital form, to the "comparison" units. The latter produce electrical signals in analogue form, and of appropriate voltage, to control servo motors for moving the table slides in the required directions. As the slides approach the first setting position, the progressively-decreasing distances that they have to travel are continuously registered by mechanically-coupled digitizers which feed the information back to the "comparison" units. As a result, the voltages to the servo motors—and, consequently, the speeds of the slides—are correspondingly reduced. Finally, when the desired setting is reached, no current passes in the circuits, so that the movements cease. At this point, when the actual setting coincides with that demanded by the punched instructions, an electrical pulse is generated which applies the table clamps, and initiates the cycle of turret head operations. When this cycle has been completed and the last spindle has been brought clear of the work, the tape advances to bring the next set of instructions to the reading position, and the process is automatically repeated.

A vertically-reading neon display panel, controlled by the digitizers, indicates which spindle is in use, also the position of the table slides to an accuracy of 0·001 in.

The Burg Tool Manufacturing Co., Inc., are represented in Great Britain by Drummond-Asquith (Sales), Ltd., King Edward House, New Street, Birmingham, 2.

Rentsch Maximatik Hydraulic Tooth Rounding Machine

Lerche Machine Tools, Ltd., Oakwellgate, Gateshead-on-Tyne, are the selling agents in the United Kingdom for the Rentsch Maximatik hydraulic machine for rounding spur and helical gear teeth, illustrated in Fig. 1. If required, the machine can be set to round one half of each tooth only, as required for starter ring gears.

Operation is fully automatic, and electrically-controlled hydraulic driving elements are incorporated. Gears from 1⅝ to 23½ in. diameter can

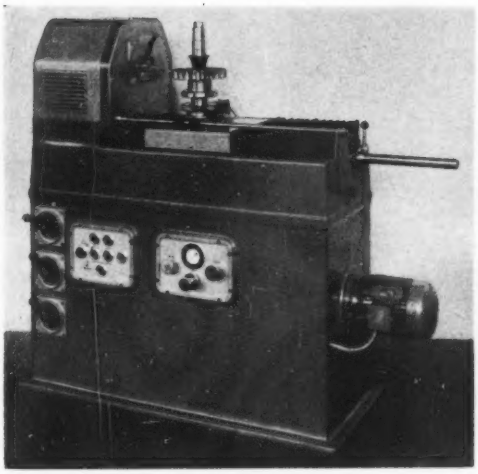


Fig. 1. Rentsch Maximatik Hydraulic Tooth Chamfering Machine

be accommodated, and the milling cutter for chamfering and rounding can be used for all pitches from 12 to 3¼ D.P.

The gear to be chamfered is clamped and centred on a mandrel by means of a tapered bush, the angular position being determined by means of a template, which may be seen in the close-up view, Fig. 2. Six interchangeable templates are supplied, to cover the range of tooth sizes. The rounding motion of the cutter, which can be adjusted to give the desired curve, is imparted by a hydraulic cylinder.

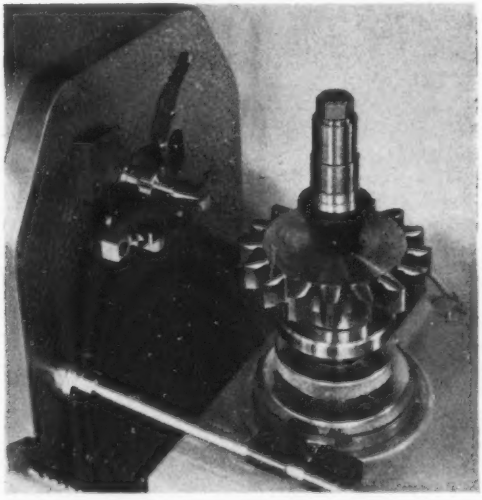


Fig. 2. Close-up View of Milling Cutter and Gear on the Rentsch Maximatik Hydraulic Tooth Chamfering Machine

After each milling cycle, the gear is moved back on its carriage, clear of the template, and is then returned to the working position after indexing has taken place automatically, in accordance with the number of teeth. No indexing gears are required, the division being determined by the movement of the carriage. The machine is stopped after the last tooth on the gear has been rounded.

Push-button control is provided for operating the various motions individually for setting-up purposes. The rounding speed and traverse motion of the carriage are steplessly-variable.

Churchill-Redman 36-in. Swing Profile Facing Lathe

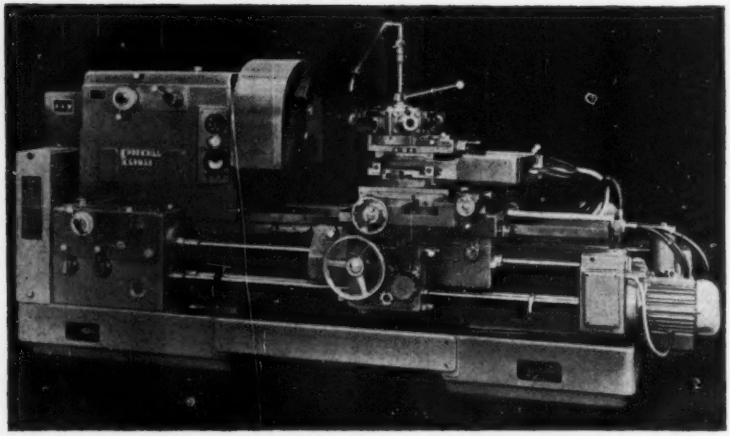
Churchill-Redman, Ltd., Parkinson Lane, Halifax, have recently built the special 36-in. swing hexagon turret lathe, shown in the accompanying figure, for a well-known shipyard, for profile-facing steam turbine discs.

Extended at the rear of the machine, the saddle is arranged to provide a cross-traverse of 30 in., so that it is possible to profile a face-width of 15 in. on each side of the centre line of the machine at one setting. The rear extension of the saddle is carried on a special bed support which provides a wide bearing area.

On the saddle cross-slide is mounted a swivelling profiling slide, which can be indexed through 180 deg., the position being selected according to the type of work to be machined. On the profiling slide is carried a 360-deg. compound slide and top slide assembly, which can also be positioned independently. A hexagon turret on the top slide is equipped with boring and facing tool-holders.

The profiling slide carries a hydraulic tracer valve, which is controlled from a template mounted in a support and located parallel with the direction of cross-slide movement. This tracer valve is of the firm's own design and manufacture, as is the hydraulic power unit for the system, which is located at the rear of the machine.

To meet the customer's requirements as regards surface finish on the components, a special headstock with plain spindle bearings has been provided, which has a speed range of 6 to 400 r.p.m. The spindle is of chromium-molybdenum

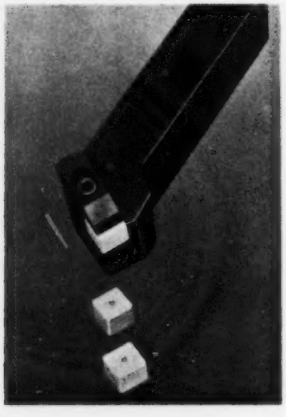


Churchill-Redman 36-in. Swing Profile Facing Lathe

nitriding steel, to ensure that it will run satisfactorily in the plain lead-bronze bearings. Front, rear, and centre plain taper bearings are provided, all of which can readily be adjusted. This new type of headstock can also be fitted to the firm's 28- and 36-in. swing L-type centre lathes, and to the 28-in. swing surfacing and boring lathe.

SPK Ceramic Cutting Tool Tips

Verrolec, Ltd., Balfour House, Finsbury Pavement, London, E.C.2, have recently been appointed distributors in this country for the ceramic cutting tool tips made by Südplastik und-Keramic, G.m.b.H., Plockingen-Neckar, West Germany. These tips are available in square and triangular shapes, and examples of the former type, also a special holder which can be supplied, are shown in the figure.



S.P.K. Ceramic Cutting Tips and Holder

Of ½- by ½-in. cross section by ⅜-in. thick, these tips have a 30-deg. chamfer 0·004 to 0·008 in. wide at both ends, to reduce the risk of chipping at the cutting edges while turning is in progress. If required, these chamfers can be removed by grinding with a diamond - impregnated wheel, and although turning can then be carried out with reduced cutting pressure, tool life is shorter. All surfaces are at 90 deg. to each other, so that the tip can be indexed and reversed in the holder to bring a total of eight cutting edges into use. The tips are intended to be discarded when all the cutting edges have become dulled, but they may be sharpened by grinding, if desired.

Of case hardened steel, the holder has a shank of 1 by 1¼ in. cross section, and is fitted with a combined finger-type clamp and chip breaker which is tightened and released by a single screw. When the tip is clamped in the holder, front and side clearance angles and a negative top rake of 6 deg. are provided. To reduce the risk of tip fracture as a result of vibration while turning is being carried out, it is recommended that the cutting edge should be set from 0·016 to 0·020 in. below the work axis. In order to maintain accuracy of workpiece profile, however, when copy and taper turning are being undertaken, the cutting edge must be set to the centre height of the work for such operations.

During a test on one of the tool tips, turning was carried out on a 12-in. diameter by 20 in. long steel bar with a tensile strength of 38 tons per sq. in. A cutting speed of 825 ft. per min. and a feed of 0·008 in. per rev. were employed, with a cut of 0·08 in. Although there was considerable vibration due to unbalance of the work at the beginning of the test, the weight of swarf produced during a period of 300 min. was 506 lb. Because of this unbalance, flank wear of the order of 0·03 to 0·04 in. was caused, although the tip was capable of further service. Another test was then carried out after the work had been balanced, and with the tool operating at a higher speed, 990 lb. of swarf was produced in 580 min. After this test also, the condition of the tool edge was suitable for further cutting.

Turret Type Carrier for Rapid Broach Changing

Two special broaching machines installed at Watervliet Arsenal, U.S.A., have enabled very substantial savings in time to be obtained. Each machine performs a series of broaching operations in the recess of the breech ring for a 90-mm. gun.

A perspective drawing of the ring, which is an alloy steel casting weighing approximately 900 lb., is shown in Fig. 1. The recess is a rectangular opening, about 8 in. wide and 6 in. high. Prior to the second world war, the recess was machined by a series of slotting and grinding operations, followed by a considerable amount of bench work.

During the second world war, the recess was broached with conventional equipment, and the amount of bench work and supplementary machining was reduced to a minimum. With the single broach carrier, characteristic of the equipment, however, various complications arose. The various broaching tools required weighed from 200 to 700 lb. each, and a crane was needed for positioning and removing them. In addition, the heavy breech ring had to be handled frequently.

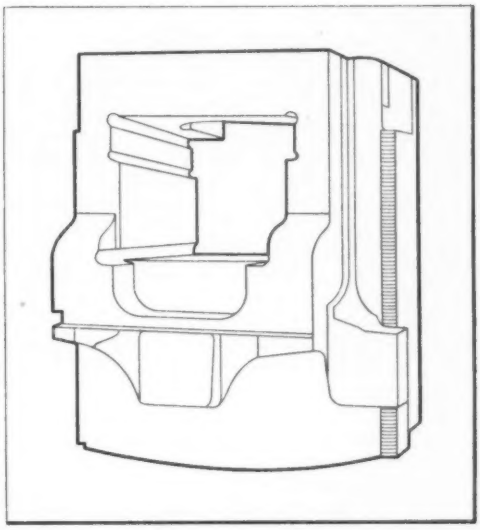


Fig. 1. The Opening in this Breech Ring is Completed in Two Broaching Sequences on Special Machines with Indexing Turret Carriers for the Broaches

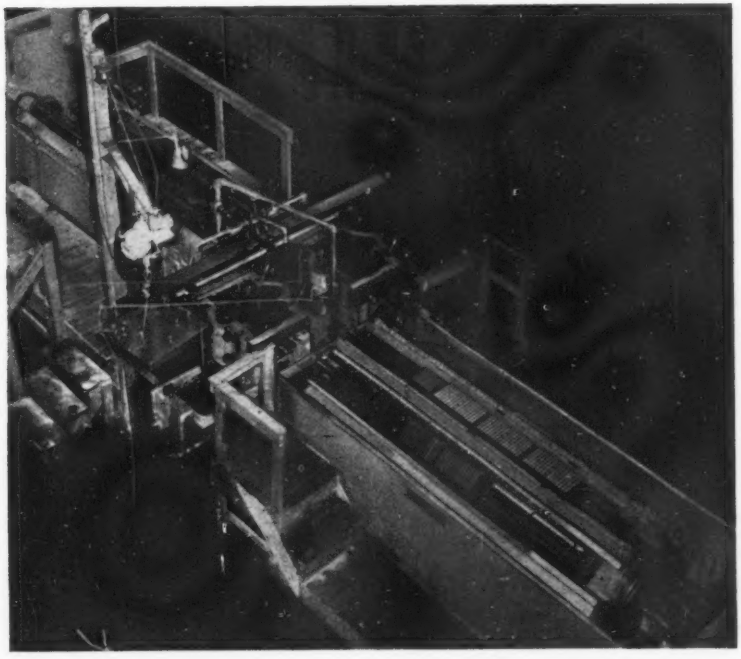


Fig. 2. Overhead View of One of the Special Lapointe Broaching Machines Showing the Indexing Turret Carrier for the Broaches

One of the two special machines now employed for these

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operations is shown in Fig. 2. The principal feature is an indexing turret carrier, on which the broach holders and their broaches are mounted in order of application. This carrier has eight stations, or runways, angularly spaced at 45 deg. The sides of the holders are gibbed to the runways, so that the holders are free to slide but will not fall from the carrier in any position of index. Each station is operative when in the uppermost position, where it is aligned with the machine pull-rod.

Two pot-type work fixtures, carried on a common slide, have a shuttle movement at right angles to the direction of broach movement. During each broaching stroke, one fixture is in line with the pull-rod and the operative broach, and the other fixture is at the side of the machine. The broach in the uppermost position is engaged by the pull-rod and drawn through the recess in the breech ring. In Fig. 3 a broach is shown advancing from the turret carrier into one of the work fixtures.

When the broach has completed its pass and is ready to be returned, the fixture slide is shuttled to an intermediate position (as in Fig. 2), so that the travel of the broach back to the turret carrier is unobstructed. Next, the slide is moved over to align the second fixture with the pull rod. The same broach is again advanced, and for the return stroke, the slide is once more shuttled to the intermediate position. At this point, the turret is indexed through an angle of 45 deg. to align the broach at the next station with the pull-rod. The cycle is then repeated.

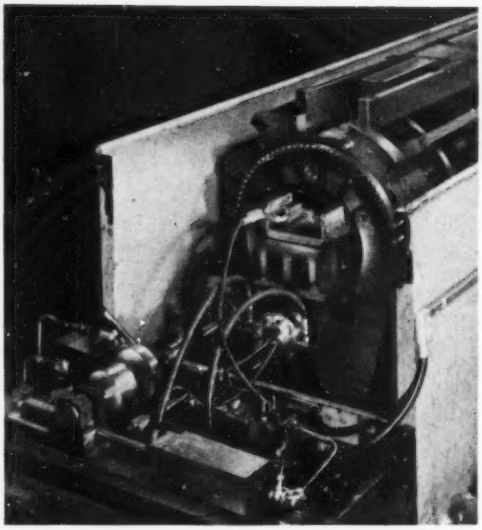

Fig. 4. The Turret Carrier is Indexed Automatically by this Hydraulic System. A Plunger Engages Holes in the Carrier Face to Ensure Accurate Positioning

Both machines and all the broaches were supplied by the Lapointe Machine Tool Co. Operations carried out on the first machine require five passes. At this stage, the breech ring is held in an inverted position in its fixture, and three walls and corner radii are completed. On the second machine, the ring is held right-way up, at a slight angle, and the fourth wall is broached to a taper. Side pockets and radii are also broached on this machine, on which a total of eight passes is required.

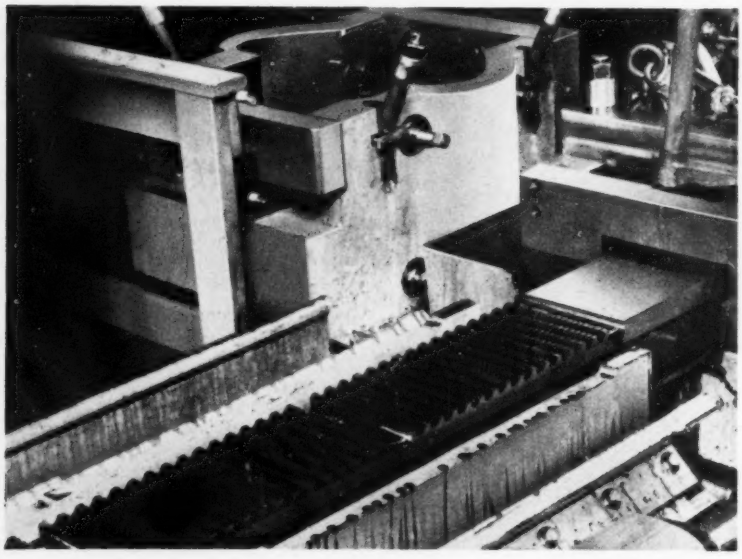

Fig. 3. The Broach is Here Seen Advancing from the Turret into the Fixture which is Aligned with the Pull-rod

The machines are of identical design, with a pull of 75 tons and a maximum stroke of 90 in. The cycle is completely automatic, and is controlled from a push-button panel. In Fig. 4 is shown a close-up view of the hydraulic equipment for indexing the turret.

Filled Epoxide Resins

Epoxide resins have, in recent years, been used on an increasing scale and have found a diversity of applications in the electrical, chemical, and engineering industries. The major attractions offered by these resins are their good adhesion to a wide range of materials, their good solvent resistance, and, when modified with inert fillers, their attractive mechanical properties.

The incorporation of metallic and non-metallic fillers in these materials results in cheaper final products, which may exhibit mechanical properties superior to those of the unfilled resin. By careful selection of fillers, moreover, it is possible to vary both the mechanical and electrical properties over wide ranges. For instance, the thermal expansion, hardness, and compressive yield stress are largely controlled by the shape of the filler particles and the packing arrangements within the polymerized resin. Similarly, the electrical properties, the thermal conductivity, and the water and solvent resistance are influenced both by the type of filler and its particle size.

The type of hardening agent used to polymerize an epoxide resin can also alter, markedly, the physical and chemical properties of the cured material, and by judicious selection of the hardener, a particular property may either be enhanced or diminished.

DEVELOPMENT WORK ON FILLED EPOXIDE RESINS

The Yarsley Research Laboratories at Chessington, Surrey, have, for some time, been engaged in research and development work within the field of epoxide resin chemistry, and much of this work has been concerned with the effects of including fillers in these resins.

As a result of these investigations certain metal and mineral filled epoxide resins have been produced, which are claimed to be of considerable commercial importance. At least two of the metal filled epoxide resins will be available to the home market in the near future, and other compositions will be introduced from time to time.

These materials will be produced and distributed by Expandite, Ltd., Chase Road., London, N.W.10, under the trade name Metaform.

Initially they will be marketed in Cellophane packs of ¼ lb., ½ lb., and 1 lb. quantities. The pack will provide a compartment for the resin and filler, and a separate pocket for a sealed capsule containing the hardener.

Two general purpose stopping compounds will be supplied initially, namely an aluminium-filled resin, and an iron-filled resin. These materials have a consistency somewhat similar to that of putty and can be easily moulded. No external application of heat is required for curing, and when the compounds have hardened, they can be drilled, sawn, tapped, ground, or threaded with conventional metal working equipment. These products, it is claimed, have good abrasion resistance and excellent adhesion to steel, iron, aluminium, lead, porcelain, glass, wood, concrete and many other materials.

It is also stated that the Metaform compounds, after being mixed with hardener, can be handled and moulded with the fingers without any risk of dermatitis. In this connection it is reported that members of the Yarsley Research Laboratories staff who have been working with the special hardeners for 12 months have experienced no skin troubles.

ENGINEERING APPLICATIONS OF METAFORM

The metal- and mineral-filled epoxide resins have numerous applications in the engineering field. They may be used for example, for repairing holes in oil storage tanks, and metal pipes, also for repairing broken castings, such as crankcases, and other metal structures which are not stressed in service. In addition, they have been successfully employed for filling blow holes in castings, and sealing oil leaks from hydraulic equipment.

It is anticipated that lead-filled epoxide resin compounds may be widely used in atomic energy installations, and other compounds will be developed to satisfy particular requirements.

MASTRIP STRIPPABLE PROTECTIVE FOR PAINTWORK.—A strippable coating composition known as Mastrip has been introduced by Croda, Ltd., Cowick Hall, Snaith, Goole, Yorks., for application over paint, baked enamel, or furniture lacquer. It is stated that this composition will not cause lifting, marring, or other irregularities, due to solvent or plasticizer action. Painted and highly-finished surfaces can thus be protected against abrasion, handling, and general mechanical damage, and the film also provides a barrier against water vapour, free water and light. Primarily intended for spraying, the composition can also be supplied in forms suitable for applicasation by brushing or dipping.

Physical Society Exhibition

The 42nd exhibition of the Physical Society was held recently in the Old and New Halls of the Royal Horticultural Society, Westminster, and it was apparent that the emphasis was still on the practical exploitation of electronics and the greater use of computing methods.

Of interest to many engineers and scientists are the various systems whereby the positions of moving mechanical elements may be determined accurately and automatically. Basic devices in this field include the circular and linear digitizers and gratings which are arranged to produce moiré fringes. Useful accessories, in certain circumstances, are the various types of digital display units.

An optical linear digitizer, shown by the Royal Aircraft Establishment, Ministry of Supply, South Farnborough, Hants., is intended to form part of a machine-tool control system in which the tool is linked directly to a small computer. It provides a serial binary output and has a resolution of approximately 50×10^{-6} in. It is understood that the working range of the production unit will initially be 6 ft., and the maximum operating speed, 3 in. per sec. The system comprises four main components: a linear scale carrying transparent lines 0·1 in. apart on an opaque ground; a reading head which photo-electrically senses the position of one of the lines and provides a corresponding serial digital output; an auxiliary digitizer of conventional commutator type to indicate which of the lines is being sensed; and an electronic unit which decodes the information from the reading head, and combines it with the output from the auxiliary digitizer in such a way that errors due to backlash are eliminated.

The method of operation is briefly as follows: A microscope objective forms an image of a portion of the scale on the surface of a glass plate carrying a pattern of transparent and opaque areas. The pattern is divided into a number of tracks extending along its length and perpendicular to the image. Each of these tracks corresponds to one of the binary variables, and at any point along its length it is opaque or transparent, depending upon whether that variable is 0 or 1 when the image of the slit falls on that part of the coded plate. A galvanometer mirror vibrating at 1 kc./s. reflects the light from each track in turn on to a photo-multiplier, the output of which gives the required serial representation of the position of the scale.

The exhibit consisted of an optical bench set up to illustrate the principle of the system, and included a short length of scale, the position of which was sensed by a reading head and displayed in a coded form on a cathode-ray tube. Hilger & Watts, Ltd., 98 St. Pancras Way, London, N.W.1, co-operated in the development of the instrument, and they also produced all the precision components.

A somewhat special type of digitizer has been incorporated in a multi-turn optical resolver, which was made by Hilger & Watts, Ltd., for the Royal Radar Establishment. In one revolution of the shaft, it gives a single reference pulse and two trains of pulses, each proportional in number to the angular displacement. One of these trains has 8,192 pulses to the revolution, and the other, 6,400.

A dark background circular glass scale is accurately divided into two concentric tracks with uniformly spaced radial slits, and there is a single slit in a third track. Behind each track is a photo-transistor to detect the slits as they transmit a fine projected image of a line-filament lamp. A second transistor, from which light is excluded, compensates for temperature effects.

The pulses from the photo-transistors of the two main tracks can be counted from a zero indication, given by the pulse from the single slit.

A positional servo control was shown by The Plessey Co., Ltd., Ilford, Essex. With this simple closed-loop system, a control transmitter feeds a signal, depending upon its shaft position, to a control transformer. The output of the latter is amplified and applied to a servo-motor in such a way as to cause the motor to drive the transformer through gearing to a null or coincidence position.

An electronic dividing attachment was shown by E.M.I. Electronics, Ltd., Hayes, Middx. If an image of a vibrating aperture is projected on to a reflecting surface which is graduated with lines, and if the amplitude of the vibration is twice the width of the line, and the engraved line has poor reflecting properties, then the reflected light will be modulated according to the relative position of the line within the image of the aperture. Displacement of the line within the image will produce modulation at the vibration frequency, the amplitude being proportional to the displacement, and the phase dependent upon the direction of

the displacement. This method of division has been applied to a machine for the automatic undercutting of the insulating segments of motor commutators, the reflecting surface being the copper of the commutator segments, and the poorer reflecting surface of the insulating slots representing the engraved lines already mentioned.

The reflected signal is applied, by way of an amplifier, to a null-setting servo which drives the commutator to a position at which the insulating slot is central within the image. A saw is mounted in a fixed position relative to this image, and a cut is made when the servo has reached the null setting. The armature is then auto-positioned for the next under-cutting operation. From loading to the removal of the armature, the entire operation is automatic, and the time required to undercut an armature with 28 slots is approximately 35 sec.

The accuracy of the positional setting, which is very high, depends on amplifier gain and the width of the setting line or slot. For the system used in the undercutting machine, the accuracy is better than 15 min. of arc, which represents 0·005 in.

A method of using an electronic positioning system in conjunction with a Microptic autocollimator was shown by Hilger & Watts, Ltd. The autocollimator is fitted with a Hilger Schwarz cell which moves with, and directly below, the normal setting lines on the graticule. In front of the cell, there is a slit that matches in width the reflected image of the target wire. When the slit is centrally positioned on the reflected image of the target wire, the resistance of the Schwarz cell is at a maximum. The reading is indicated on a micro-ammeter which gives a more open reading than the direct visual setting in the eyepiece, and is therefore less tiring to use.

The optical resolver demonstrated by Hilger & Watts, Ltd., involves a new application of moiré fringes. In this instrument, two circular gratings are used, one being fixed and the other attached to a shaft. The angular displacement of the shaft, as it turns, is measured by counting the fringes. To distinguish between clockwise and counterclockwise rotation, the fringes are detected by two photo-transistors so positioned that their approximately sinusoidal outputs are about 90 deg. out of phase. A discriminator in the associated circuit accepts one phase for clockwise counting and the other for counterclockwise counting.

Equipment for measuring vibration by the use of the moiré-fringe technique was shown by the National Physical Laboratory, Teddington, Middx. A 1-in. square glass block, with a diffraction grating on its surface, is used as a fixed reference, and a similar block is rigidly connected to the vibrating element. A four-faceted lens is employed to pick up transmitted light from the moiré pattern at four points on the sinusoidal distribution at which the amplitude is progressively 90 deg. out of phase. The light from these points is separately received on transistor photo-cells and serves to produce a circular trace on a cathode-ray oscilloscope. A trace in the form of a complete circle indicates an amplitude of vibration equivalent to the spacing of the grating used, and, for a grating of 1,000 lines to the inch, would represent an amplitude of 0·001 in. The indication is independent of electrical errors, and pick-up distortion can be eliminated by adjustment so that the trace is circular and not elliptical.

DIGITAL DISPLAYS

There is a tendency to convert readings of the usual dial-and-pointer type into displays of digits, and a number of ingenious conversion and display systems has been developed. An example is a digital voltmeter, which was shown by the Solartron Electronic Group, Ltd., Thames Ditton, Surrey. This instrument measures an input voltage to an accuracy of 0·1 per cent, and has a read-out time of approximately 0·5 sec. Each digit of the measured voltage is separately displayed by a cold-cathode "number" tube. This tube consists of a cold-cathode lamp with a series of electrodes, each formed to represent one of the digits 0 to 9, and the electrode to which the operative potential is applied becomes enveloped in a glow and thus constitutes an illuminated number. Two such "number" tubes are incorporated in the unit illustrated in Fig. 1.

As complementary units to their edge-

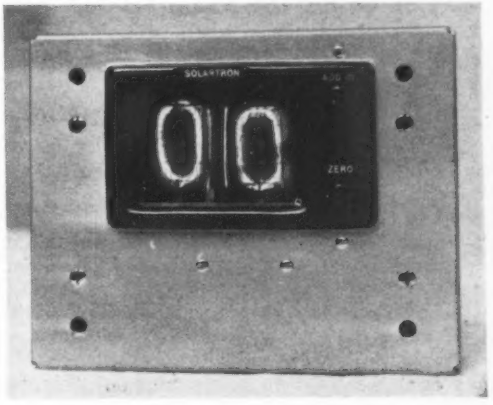

Fig. 1. The Solartron Digicator

illuminated digital indicators, Hilger & Watts have introduced projection in-line indicators for applications where decimal displays must be viewed from a considerable distance or from a wide angle. With this indicator, the numbers to be displayed are projected on a diffusing screen by means of a simple optical system.

The use of a dekatron display for the timing of a routine test was illustrated by type D.4136 viscosity timer exhibited by Labgear, Ltd., Willow Place, Cambridge. An independent timing channel for each group of standard viscosity testing tubes is provided, and a visual display of time is given, which is accurate to within 0·01 sec. The display unit contains eight 5-stage dekatron channels which are driven from a common master time source, with an optional output of 100 or 10 pulses per sec. derived from A.C. mains. Greater accuracy may be obtained, if necessary, by employing a temperature controlled quartz-crystal time standard.

One modern method of imparting movement to liquid metals such as mercury, bismuth, and the sodium-potassium alloys, is by means of electromagnetic pumps. The action of such a pump depends on the usual movement of a current in a magnetic field. Current is carried by the liquid metal, which is urged at right-angles to the direction of the field. An electromagnetic pump, made by the Research Laboratory of the British Thomson-Houston Co., Ltd., Rugby, and capable of pumping 20 gal. per min. at a pressure of 20 lb. per sq. in., is shown in Fig. 2. Such a pump avoids the need for moving parts, also glands and seals. For laboratory scale duty, the single-phase conduction pump, with combined transformer, is convenient.

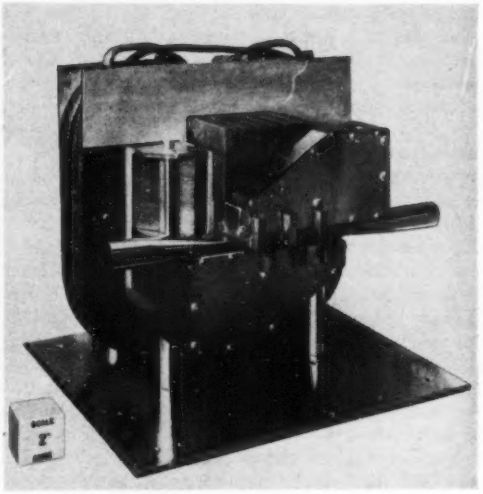

Fig. 2. B.T.H. Single-phase Conduction Pump for Liquid Metals

COMPUTERS

Some ancillary computing equipment was shown by the Armament Research & Development Establishment, Ministry of Supply, Fort Halstead, Kent. This computing and data handling equipment illustrated the advantages of semi-conductor devices and plug-in printed circuits. Four basic units of a fast parallel multiplier were shown, arranged to multiply two numbers each of nine binary digits. The operations of successive additions and shifting are carried out simultaneously. In addition, equipment was shown for comparing two reels of punched paper tape at high speed. The driving mechanism stops at any position of disagreement between the two tapes. The speed of operation is greater than 100 characters per sec. (10 in. per sec.).

Analogue and digital magnetic record-replay heads were exhibited by E.M.I. Electronics, Ltd. These heads are of two types. Type "A" is a magnetic head which can be supplied in either single- or multi-track units up to 1-in. high. The construction is readily adaptable for recording, replay or erase heads, and by a suitable choice of gap dimensions these heads can be used either in contact or out of contact for both analogue and digital signals. In multi-track form, individual blocks containing up to five heads for use on ¼-in. tape, or ten tracks on ½-in. tape, can be provided. By using interleaving blocks, a track density of 24 on a 1-in. tape is achieved.

Type "B" is a simple head designed for digital work out of contact with drums and tape. A track packing density of 24 to the inch may be obtained, using blocks up to 4 in. long (96 tracks in 4 in.).

In addition, E.M.I. Electronics, Ltd., showed equipment for analogue-digital conversion. This equipment consisted of one encoder and two decoder tubes. When fed with a saw-tooth scanning voltage and with the analogue to be measured, the encoder tube delivers a binary or "Grey" coded signal. This signal is caused to modulate a r.f. carrier in the v.h.f. or centimetric frequency bands, preferably by frequency modulation, in which the presence of a pulse shifts the frequency in one direction, and the absence of the pulse leaves the frequency on its mean value.

At the receiving end, the carrier is demodulated.

The output of the demodulator, consisting of a series of pulses in sequence, is fed into the analyser tube, which sorts out the presence or absence of pulses during one scanning period. The scanning throughout the encoding and decoding system is controlled by a synchronizing pulse or pulses generated at the encoding end.

After the pulses have been sorted out, they are stored in Eccles-Jordan circuits until the scanning is complete, after which they are delivered to a summing tube and the corresponding analogue quantity is produced across a common load resistor.

A single-crystal memory store was shown by the Plessey Co., Ltd. Such compact information stores can be obtained by evaporating or printing electrode systems on to single crystals of barium titanate. Although such devices have access times that are slightly lower than those of analogous magnetic devices, they can operate at the low powers and voltages obtained from transistors.

Some new acoustic delay lines for digital storage systems were shown by Ferranti, Ltd., Hollinwood, Lancs. These lines are made in two sizes giving up to 300 binary digits delay, and from 300 up to 2,000 binary digits delay.

The same company also had on view a type TR5 fully-transistorized photoelectric tape-reading unit, capable of operating at speeds up to 300 characters per sec. A simple adjustment of a guide adapts the reader for 5-, 7- or 8-unit punched paper tape, provision being made for reading all eight channels.

The punched-tape reading and editing unit shown by Dobbie McInnes (Electronics), Ltd., 55 Kelvin Avenue, Glasgow, S.W.1, is designed to accept tapes which have been punched for tabulation and other purposes, and to select certain information and supply it to an X-Y recorder.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17, have designed a single basic transistor circuit from which a complete computing system may be constructed. A binary-decimal converter constructed entirely from these basic units was shown, which will accept any 3-figure decimal number set-up manually, convert it into the corresponding binary number, and display the latter on indicator lights.

A demonstration was given by Elliott Bros. (London), Ltd., Century Works, Lewisham, London, S.E.13, of their 402F. floating point, computer. This equipment comprises the 402E computer with three extra cabinets, and can operate under programme control either in fixed or floating point mode. Under the latter it can deal with numbers in the range 2^{-30} to 2^{+31} with sign, and enables problems to be solved where the data would otherwise go out-of-scale.

COUNTERS

A batch counter designed for both batch counting and summation counting was shown by Burndept, Ltd., West Street, Erith, Kent. By the simple addition of a frequency generator, it can easily be converted into an accurate interval timer. Any batch quantity from 1 to 9,999 may be pre-selected by switches, and the output circuits arranged to operate batching mechanisms. A second set of switches provides another output pulse at a separate pre-selected number. This pulse may be used to provide a warning near the end of a batch, or to reduce the speed of machinery employed, for example, for material cutting.

Exhibits of Avo, Ltd., Avocet House, 92-96 Vauxhall Bridge Road, London, S.W.1, included a magnetic memory scaling unit with magnetic indicator. In this small, light-weight unit, of very low power consumption, minute ferrite magnetic cores are employed as bi-stable elements in a scale-of-ten circuit, also a new form of magnetic count indicator in which the currents flowing in the scaling circuit magnetize thin strips of nickel-iron mounted around a balanced pair of compass needles.

A counting system developed by the G.K.N. Group Research Laboratories, Ltd., was shown by Associated Automation, Ltd., Dudden Hill Lane, London, N.W.10. A low-voltage system is earthed by the part being tested, and a current is thus initiated, which triggers the counter. Provision is made for eliminating double counting or contact bounce as the parts are counted.

The batching counter shown by Venner Electronics, Ltd., Kingston By-Pass, New Malden, Surrey, contains four digital decades, each arranged, in conjunction with a Schmitt trigger stage and a 10-position switch, to give one output pulse when the number set on the switch has been reached. This batching facility is available up to frequencies of the order of 10 kc./s., and the equipment may be used to produce a known time delay when fed with the output of a frequency source such as a 10 kc./s. crystal oscillator.

ULTRASONICS

A demonstration of welding metals without fusion was given by Mullard, Ltd., Mullard House, Torrington Place, London, W.C.1. This method is known as ultrasonic cold welding. The two pieces of metal to be joined are pressed together and one of the pieces is caused to vibrate laterally at a supersonic frequency. This wiping action has the effect of removing oxide films and other contaminants. The static thrusts required are

fairly small, for example, up to 300 lb. on a 1-in. radius tip, and the consequent deformation is slight. Such welding is more easily achieved with the softer metals such as aluminium, copper, and nickel. There is a limiting thickness for the vibrated piece, but no limit for the stationary piece. For the demonstration, an ultrasonic input ranging up to 2 kW. was employed to actuate the laminated nickel magnetic-strictive transducer.

A ferrite material suitable for medium-power ultrasonic generation was shown by The Plessey Co., Ltd. This material has an electro-mechanical coupling coefficient of 0·3 with an external biasing field. At remanence, the coupling coefficient is 0·2, and low power use is possible without an external field.

Improvements in ultrasonic flaw detection have resulted from investigations carried out by the National Physical Laboratory. By making piezoelectric crystals into sandwiches and switching the interconnecting foils, a frequency range of 7 : 1 can be covered, and the probes can radiate through water and oil. This system eliminates contact errors. Glass blocks with air bubbles are employed as flaw standards, and are compared with blocks drilled with flat-ended holes.

Equipment for ultrasonic cleaning was shown by Dawe Instruments, Ltd., 99 Uxbridge Road, Ealing, London, W.5. With this equipment, cleaning occurs as a result of the rapid formation and collapse of vapour bubbles within the liquid. The cavitation enables many assemblies to be cleaned which are difficult or impossible to treat by other means. Attention may be drawn to a newly-developed rectangular tank and transducer assembly (type 1160/T52), which has a capacity of approximately 2 gal., and to welded stainless steel immersible bulkhead transducer units (types 1161/B18 and 1161/B36). The latter enable existing baths to be readily adapted for ultrasonic cleaning. With the type 1151 Soniclean generator, a peak output of 4 kW. can be obtained. It will supply eight type 1161/B36 immersible transducers, with a total radiating surface of about 340 sq. in., and provide for uniform ultrasonic cavitation in 20 gallons of cleaning solution.

INSPECTION AND TESTING

Shown by the Director of Artillery (Research & Development) Ministry of Supply, Hook Rise, Tolworth, Surrey, was a pneumatic gauge for testing the flatness of the sensitive surface of photographic plates measuring 9½ by 9½ in. The surface is gauged by 22 jets, and the range of the measurement is ±0·020 mm.

Nash & Thompson, Ltd., Oakcroft Road, Chessington, Surrey, displayed the Duplex model of the B.N.F. coating-thickness meter. This instrument has been developed for measuring, non-destructively, the thickness of thin films of metal on different base metals, independently of their magnetic properties. It is primarily intended for checking electro-deposited films. The thickness is indicated on a 4-in. rectangular meter when a hand or a jig-held probe is applied to the specimen under test, and another electrical contact is made either by a separate clip or through the jig.

The instrument is set by means of two samples of known thickness, and, with the first batch of instruments, calibration samples of nickel on steel are being supplied. Subsequently, other standards may be available, or they may be prepared by the user with materials identical to those with which he is concerned. There is provision for fitting demountable scales which may be prepared for different metal combinations. If required, a second probe may be attached to the instrument and its circuit calibrated independently of that of the first probe. It will then be possible to measure the thicknesses of dual coatings when the technique has been fully developed by the British Non-Ferrous Metals Research Association.

The range of the instrument for nickel on steel is from about 0·0001 to 0·005 in., and the probable error of a single determination is of the order of 10 per cent. A 50-cycle, 200/250-volt supply is required with an input voltage selector, also a long-life internal battery (Mallory type RM.12).

A nucleonic thickness gauge which has been developed by Burndept, Ltd., is an adaptable instrument in which a basic rate-meter may be matched with a detector chosen to suit a particular application. It was demonstrated as a transmission thickness gauge, a scintillation counter being used to detect beta radiation. The use of a rate-meter allied to a scintillation counter enables a low-activity source to be employed, so that there is a wide margin of safety for the operator. Back-scatter technique can also be employed with the same basic rate-meter.

Gauging by means of beta rays was also demonstrated by Isotope Developments, Ltd., Beenham Grange, Aldermaston Wharf, Berks., with an instrument that has been developed for checking the thickness of hollow turbine blades. The same company showed a gauge for indicating the thicknesses of plates and pipe walls when only one side is accessible. Operation depends on the back-scatter of gamma rays, and the instrument is useful for checking internal erosion or accumulation of scale.

A type N563 back-scatter gamma gauge for similar applications was shown by Ekco Electronics,

Ltd., Southend-on-Sea, Essex. The principle of operation is that when gamma rays pass through steel, a proportion is deflected by "Compton scattering," and some of the rays are scattered through 180 deg. During this process, they lose energy to the extent of twice the Compton wavelength. If cobalt-60 is used as the source, the back-scattered radiation will return at about 200 kev. The unit has a built-in. e.h.t. supply for the photo-multiplier tube, and has suitable time-constants to prevent random fluctuations on the indicating meter. In the construction of the instrument, transistors are employed in conjunction with printed circuits. The useful range of the instrument, it is stated, extends up to 1-in. thickness in steel.

Another exhibit by Ekco Electronics, Ltd., was the type N582 auto-standardization nucleonic gauge for measuring the substance, or weight per unit area, of a wide range of materials. A measuring head is fitted with a retractable scanner which is automatically withdrawn from the sheet at half-hourly intervals, and control circuits housed within the console carry out a sequence of tests and correct any errors which have been introduced since the previous standardization. These tests cover source decay, contamination of the source and the window by deposition of dust, and the balance and sensitivity of the amplifier. The unit shown was fitted with a type N604B controller whereby the output signals from the gauge are applied to control manufacturing equipment, such as a calendar or coating machine. Automatic scanning facilities are provided to enable the material to be investigated across its width at predetermined intervals, and a fault alarm system is incorporated to give warning of breakdown or failure to operate correctly.

A micro-hardness tester designed for use with a standard bench type metallurgical microscope was shown by Associated Automation, Ltd. This instrument has been designed for the measurement of hardness of materials microscopically, at selected points. The test is similar to the Vickers, the indentation loads ranging from 1 to 100 grammes. Small impressions are obtained, for example, 7 microns (diagonal) with a 30-gm. load on 1140 VPN tungsten carbide.

An interferometer of the shearing type for testing roundness was exhibited by C. Baker of Holborn, Ltd., Metron Works, Purley Way, Croydon, Surrey. With this instrument, which is designed to test the sphericity of concave surfaces of practically unlimited radius and of convex surfaces up to about 8-mm. radius, the shear is obtained by bi-refringent components. It is also possible to test cylindrical surfaces. Roundness of a surface is checked independently of the radius, and the instrument can be employed for testing lens and mirror surfaces, the surfaces of precision bearing balls, and precision shafts.

An instrument for detecting, tracing, and determining the depths of buried pipes and cables, also for tracing metal in timber, was demonstrated by Rank-Cintel, Ltd., Worsley Bridge Road, Lower Sydenham, London, S.E.26. It is a transistorized version of previously available equipment, and has the advantage of lightness combined with portability and low power consumption. A 6-in. pipe can normally be detected at 3 ft., or, with a special 1 kc./s. oscillator, at about 30 ft.

A range of special non-destructive testing equipment was exhibited by A. E. Cawkell, Electronic Engineers, 6-8 Victory Parade, The Broadway, Southall, Middx. This range includes three instruments for the measurement or control of certain properties of engineering materials. With the LDA(M) equipment, the specimen is excited into vibration at a resonant mode, the vibrations are cut off, and the number of vibrations occurring in a predetermined time interval is noted. It is stated that the method is extremely sensitive, and may be used to measure, observe, or control changes of internal state due to hardening, temperature, stress, or crystallization, also to detect lack of homogeneity, flaws, and porosity.

Fluorescent spectrometry is now being adopted as an accurate method of chemical analysis. An instrument which has recently been introduced for this purpose is the type X2736 X-ray fluorescent spectrometer, shown by the Solartron Electronic Group, Ltd. A beam of very hard X-rays is directed on to the test specimen, to energize the orbital electrons of the various constituent elements. These electrons vibrate in distinctive modes according to the nature of the material, and re-emit X-rays of characteristic wave-lengths. The

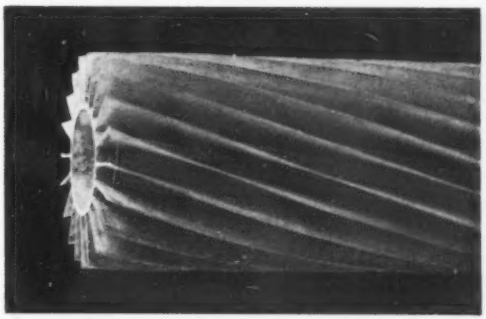

Fig. 3. Finned Tube for Canning Uranium for Use in Atomic Reactors

secondary rays are collected in a suitable collimator, refracted by a crystal such as calcite, and detected by a Geiger counter. The crystal and the counter are automatically moved to certain (Bragg) angles, to identify the elements present in the sample. For any one analysis, 24 such angles can be programmed and accuracies to the order of 0·1 per cent of content can be achieved.

A thermal comparator, shown by the National Physical Laboratory, is a device of considerable versatility. It consists of two similar metal balls, mounted in insulating material and carrying differentially connected thermocouples. After the unit has been heated to a constant temperature excess, it is allowed to rest with one ball in contact with the test surface, and the differential e.m.f. observed after 10 sec. is a function of the thermal conductivity of the test material.

Since the condition of the surface affects the readings, the device can be used to measure surface finish. Other possible applications are the estimation of film thickness and the non-destructive sorting of materials.

The canning of fissile materials for use in atomic piles has presented a number of problems, some of which have been solved by the use of special metals and manufacturing methods. Examples of tubular cans were among the exhibits of Accles & Pollock, Ltd., Oldbury, Birmingham, and a finned section for canning uranium is shown in Fig. 3 This tubing may be of aluminium, magnesium-aluminium alloy, or niobium.

Trade Publications

SLACK & PARR, LTD., Kegworth, near Derby. Folder devoted to the company's range of geared, fixed centre type, multi-spindle drill heads. A sectional view of a typical head is included.

HELLERMANN, LTD., Crawley, Sussex. Folder with illustrations and brief descriptions of the company's hand tools which include wire strippers, wire cutters, wire snips, and side cutters. Reference is also made to a tool kit for the Hellermann system of binding and insulating cable ends.

LEON DAVIS & CO., 9 Laurence Pountney Lane, Cannon Street, London, E.C.4.—Folder containing samples of a wide range of gummed paper tapes including qualities suitable for containers and bales, and parcelling, also printed and coloured tapes. In addition, examples of gummed tape sealing machines are illustrated.

ELECTRIC RESISTANCE FURNACE CO., LTD., Netherby, Queens Road, Weybridge, Surrey.—Illustrated folder describing the Alnor dew point meter which has a measuring range covering dew points from —80 deg. F. to room temperature. This instrument finds applications in the heat-treatment of metals, refrigeration, air conditioning of buildings, and manufacturing processes.

THE ENGLISH ELECTRIC CO., LTD., Foregate Street Offices, Stafford. Folders concerned with the company's switchboard instruments of moving coil type in round and square shapes, the former being arranged for flush and projection mounting, and the latter for flush mounting. Other folders are devoted to moving coil panel instruments of round, square, and rectangular flush patterns.

DELORO STELLITE, LTD., Highlands Road, Shirley, Solihull, Warwickshire.—Service bulletin No. 13 is concerned with applications of Stellite for a variety of purposes, including the hard-facing of press tools, paper shearing knives, and tools for hexagon nut production; cutting tools for use on automatics and for planing glued wood; and for tipping chasers for a 50 t.p.i. thread in magnesium.

T. NORTON & CO., LTD., Carver Street, Birmingham, 1.—Stock list covering the company's range of ground flat stock which can be supplied in a variety of sections, and in lengths of 18, 24, and 36 in. Nearly 600 different sizes are listed.

CHLORIDE BATTERIES, LTD., Exide Works, Clifton Junction, Swinton.—Booklet giving particulars of Exide batteries, also a wide range of Drydex batteries for use with light electrical and electronic equipment. A page is devoted to Drydex socket diagrams.

AYLING NUCLEAR EQUIPMENT CO., LTD., Horsham, Sussex.—Brochure devoted to remote handling equipment for atomic research work, electronic control gear, testing apparatus, and special-purpose machinery made by the Ayling Industries Group of companies. The text is in English, French, German and Spanish.

MAX ARC & ELECTRICS, LTD., Terrace Road, Walton-on-Thames, Surrey.—Folder concerned with the Port-El-Arc transportable welding unit which is powered by a Volkswagn petrol engine. These units can be supplied with various arrangements of wheels and skids or for mounting on customers' vehicles. Outputs range from 20 to 300 amp.

IMPERIAL CHEMICAL INDUSTRIES, LTD., Imperial Chemical House, Millbank, London, S.W.1.—The March issue of *Pretreatment News* includes an article on the Serseal process for preventing the escape of steam and fumes from processing tanks. Another article is concerned with the Granodraw process for facilitating the cold forming of steel.

BRITISH INDICATORS, LTD., Sutton Road, St. Albans, Herts. Catalogue of 32 large pages covering the wide range of John Bull precision measuring instruments which includes dial, cylinder bore, Intercheck, Minicheck, deep hole, dial depth, dial sheet caliper, and A.P.I. gauges; also test sets, comparators, and a hand micrometer. The recently introduced Checkmaster comparator and the type 220 dial snap gauge are listed for the first time.

News of the Industry

Manchester and District

LIMITED DEMAND FOR PIG-IRON. With adequate supplies available, and short-time working in some sections of the foundry trade, fresh business in No. 3 Midland irons is still limited to prompt or early delivery, aggregate consumption being maintained at about the recent level. The light castings section has been affected by the contraction of demand from the building trades and for domestic appliances. On the whole, the most satisfactory reports come from the speciality and heavy engineering foundries, although order books generally are much lighter than they were a few months ago. The call for West Coast hæmatite iron is fairly steady, and finished iron materials, including crown and best bars, are being taken up in moderate quantities.

REDUCTION IN STEEL PRICES. The Iron and Steel Board recently announced reductions in the maximum prices of many steel products. Basic price reductions include: light sections and bars, and wire rods, 7s. 6d. a ton; plates and heavy sections, 10s.; strip mill sheets, 20s.; and cold rolled strip, 35s. In the Lancashire area, fresh buying of steel materials is on a smaller scale than it was a short time ago. Activity is greatest in connection with steel plates, large-diameter bars, special alloy steels, and semi-finished materials.

RUSSIAN TYRE FACTORY. Further orders, valued at £5,000,000, for the large Russian tyre factory mentioned in MACHINERY, 91/718—20/9/57, have been placed with David Bridge & Co., Ltd., Castleton, Rochdale; Lancashire Dynamo & Crypto, Ltd., Trafford Park, Manchester; Mather & Platt, Ltd., Manchester; Francis Shaw & Co., Ltd., Manchester; and Crompton, Parkinson, Ltd., Guiseley, Yorks. It is estimated that the output of the factory will be 2,000,000 tyres a year, and delivery of the equipment is due for completion by the end of 1959. The total value of the contracts placed is £12,500,000.

KENDALL & GENT, LTD., Gorton, are busy with orders for plano-milling machines, vertical milling machines, screwing machines, and broaching machines, some of which are destined for export. In the works, our attention was drawn to various components for the 37½- by 12- by 9½-ft. plano-milling machine, with four 100-h.p. self-contained milling heads, which is destined for C. A. Parsons & Co. Ltd., Newcastle-on-Tyne. The approximate weight of this machine will be 400 tons. In addition, we noted two openside-type machines of 30 by 7 by 6 ft. capacity which are being built for Lancashire and Yorkshire engineering works, and two face-type plano-mills for the aircraft engine industry. Mention may also be made of a 7-ft. diameter rotary table, mounted on a traverse bed, which is provided with optical equipment, and has both automatic feeds and rapid traverse movements in the longitudinal and rotary directions. Activity is well maintained in the inserted-blade spiral milling cutter and screwing die departments of the works.

We hope shortly to make further reference to the third and largest of the plano-milling machines recently installed in the Larne factory of the British Thomson-Houston Co., Ltd., which has a

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Dr. D. F. Galloway (second from right), Director of the Production Engineering Research Association of Great Britain, discussing vibration research with Professor N. N. Zorev (right), head of the U.S.S.R. Central Scientific Research Institute for Technology and Heavy Machine Building, Mr. G. N. Krasnitsky (left), and Prof. V. V. Boitsov, in the Association's Melton Mowbray laboratories. The Russian party visited PERA during the course of a stay of about ten days in Britain to study developments in the technology of engineering manufacture

capacity of 30 by 12 by 8½ ft., and weighs approximately 300 tons. On the cross rail of this machine there are two 60-h.p. milling heads, and an Asquith O.D.5 boring head at the rear, to enable various machining operations to be performed at one setting of the work.

BRAYSHAW FURNACES & TOOLS, LTD., Belle Vue, have a good order book for their various types of gas, oil, and electric furnaces. Recent orders cover three large bogie-hearth furnaces. Two, with load capacities of 250 and 150 tons, are destined for Glasgow, and one, of 250 tons, for Sheffield. These furnaces are of the recirculation type, for maximum temperatures up to 900 deg. C. A contract from Thailand includes electric furnaces, salt baths, and a high-speed steel tempering furnace, and for the Openshaw Technical College we noted an electrically-heated oven furnace and salt baths. For the pottery department of Acton Technical College, two high-temperature muffle furnaces are on order, which will have heating chambers of 17½ by 17½ by 24 in. and provide a maximum temperature of 1,400 deg. C. For a vertical furnace for testing refractory materials, gas and oxygen will be employed to give a maximum temperature of 1,850 deg. C. We also noted, in progress, standard high-speed steel hardening and tempering furnaces, salt baths, melting furnaces, and two shaker-hearth furnaces.

The tool and cutter section of these works is experiencing a steadily-maintained demand for both standard and special milling cutters, including inserted-blade types and cutters of large size. In the works, we noted a recently-installed Cunliffe & Croom plain milling machine, fitted with generating equipment for screw milling and worm threading hobs of large sizes. Another recent addition to the plant is a WGW vertical hydraulic keyseater for keyways up to 2¾ in. wide and 20 in. long, in bores up to 11 in.

HERBERT HUNT & SONS, LTD., Old Trafford, report a well-maintained demand for twist drill sharpening machines for drills from $\frac{1}{64}$ to 4 in. diameter, and for twist drill manufacturing machines for flute milling, and clearance milling and grinding, also for tap and reamer manufacturing machines for flute milling, relief grinding, and flute grinding. Orders are also in hand for tap sharpening machines in the range from $\frac{1}{16}$ to 6 in. diameter and for tool and cutter grinding machines. A steady call is maintained for Pearns tapping attachments and accessories. India, Australia and Italy have been among recent export customers.

ROBERT KELLY & SONS, LTD., Machine Tool Division, Newington, Liverpool, have recently completed extensions, which include new machine tool showrooms where a considerable variety and range of machine tools and small tools are available for prompt delivery. The showrooms, a part of which is seen in the accompanying illustration, are permanently wired with Pyrotenax and Reyrolle fittings, so that any machine in stock can be demonstrated, and a compressed air installation provides for the demonstration of pneumatic tools, mist cooling equipment, and air chucks and vices. Lathes ranging from 3½- to 10½-in. centres, in 1-in. increments, are normally maintained in stock. Some of the machines noted during a recent visit included a Harrison 5½-in. centre copying lathe, a Woodhouse & Mitchell turret milling machine, standard milling machines of various

A View in the New Machine Tool Showrooms of Robert Kelly & Sons, Ltd., Newington, Liverpool

capacities, and air compressors of 2½ to 60 cu. ft. per min. capacity. This firm maintains a service department, and a service engineer, who has received training in the works of several manufacturers, is available to assist customers with advice and demonstrations. The company has recently been appointed sole distributor for Lancashire, Cheshire and North Wales for Wadkin-Bursgreen wood-working machinery. H. B.

Conference on Compressed Air

A conference with the theme "Improving Productivity by the Use of Compressed Air" was held at the Cornwall Technical College, Camborne, on April 9 and 10. Organized by the Cornwall Section of the Institution of Production Engineers, it was attended by about 150 delegates, representing manufacturers and users of compressors and air-operated equipment of all types. A total of five lectures was delivered, and on the afternoon of the first day four films were shown, concerned with the manufacture and applications of compressed air equipment, with particular emphasis on installations which have had noteworthy effects in increasing production, reducing manual handling, and lessening operator fatigue.

On the first day, three papers were read, namely "Industrial Uses of Compressors," by Mr. J. Hodge, M.A., Head of the Consultancy Department, Power Jets (Research and Development), Ltd.; "Fire and Explosion Hazards in Compressed Air Systems," by Mr. A. C. Smith, B.Sc., A.F.Ints. Pet. of Shell Petroleum, Ltd., and Dr. A. Thomas, B.Sc., D.I.C., A.R.C.S., research chemist with the same organization; and "Air Gauging," by Mr. C. J. Tanner, of Solex Gauges, Ltd. The speakers invited questions after each paper had been read, and time was afforded for full discussion of the subjects.

A number of firms represented at the conference had taken advantage of the facilities provided for exhibiting products, and an interesting display of pneumatic equipment and auxiliary appliances was arranged. The afternoon of the second day was devoted to a tour of the latest dock installations at Falmouth, organized by Mr. Walton-Lund, of Silley, Cox & Co., Ltd.

The conference was opened by the President of the Institution of Production Engineers, The Rt. Hon. The Earl of Halsbury, F.R.I.C., F.Inst.P., M.I.Prod.E., who recalled that the first conference on compressed air was staged by the Cornwall Section in April, 1955.

In his speech, Lord Halsbury remarked that, broadly speaking, there were four main methods of effecting or controlling motion, namely mechanical, electric, hydraulic, and pneumatic. Of these, the latter had certain advantages to offer, as compared with the others. Engineers, the speaker continued, were constantly seeking for means whereby a signal and power could be transmitted through the same channel, and, as a simple example, the case of a cam-operated automatic was quoted. The disadvantages of this solution were that the component parts must be sufficiently robost to transmit the required power, and must have a high order of precision. Moreover, considerable time was needed for setting-up and adjustment. Pneumatics could be used for such applications, and permitted the transmission of the signal and the power required through one channel with safety and cleanliness. It was interesting to note, he continued, that in the field of electronics there was no exact equivalent to the functions provided by the piston and cylinder, and the diaphragm valve, as used in pneumatic circuits.

Turning to other uses of compressed air, particularly for gauging and control systems, Lord Halsbury expressed the opinion that development engineers were only on the threshold of discoveries in this field. As an example of the sort of problem which could be solved simply and economically by the use of compressed air, he cited the instance of a computer which incorporated a 4-ft. 6-in. diameter drum and a reading head. The problem was to maintain the gap between the head and the periphery of the drum within close limits, bearing in mind the eccentricity and out-of-roundness present in the drum. This problem was solved by mounting the head on flat springs, so that it could move towards and away from the drum, and allowing compressed air, introduced through a tube coaxial with the reading head, to discharge freely on to the surface of the drum. With the aid of a suitable valve, the back pressure served to maintain the gap at the required figure within an accuracy of $\pm 0{\cdot}0001$ in.

Further reference to the papers listed above, and the discussions that followed, will be made in MACHINERY in the near future.

Practical Training for Graduates

A report which has been prepared with the object of defining standards of practical training in mechanical engineering, with particular reference to graduate engineers, has recently been published by the Institution of Mechanical Engineers, 1 Birdcage Walk, London, S.W.1. Compiled by a committee under the chairmanship of Mr. H. G. Conway, M.A., M.I.Mech.E., F.R.Ae.S., the report has not yet been adopted by the Coun-

cil of the Institution as representing accepted policy, but has been issued for comment. It is emphasized that practical training, for which a period of 18 months has hitherto been recommended, is essential for all professional engineers, that the basic training should be properly taught rather than acquired in a haphazard manner, and that the remainder of the training should bear some relationship to the type of work with which the individual will be ultimately concerned. The committee emphasize the general principle that theoretical- and practical-training studies should be closely co-ordinated to ensure that the total training period is treated as an integrated whole as far as possible. It is pointed out that the order in which practical and theoretical elements of training are arranged at the present time is not uniform throughout the country, and in this connection reference is made to different schemes—all of which have certain merits—operated by universities and technical colleges.

Appendices to the report include a suggested syllabus of training and this provides for a workshop course of six to nine months duration. Drawings of proposed test pieces intended to show the problems associated with turning, milling, grinding, casting, and welding, are reproduced, and the reasons for choosing the various exercises are explained in detail. It is suggested that there should also be secondary training in various departments and offices in industry, and that the total period involved should be two years.

The Economic Survey

(*Continued from page* 875)

cent fall in import prices during last year. Reduced or at least stable prices would clearly be of great assistance in meeting the increased competition that may be expected overseas.

It must not be forgotten, however, that prices depend much more on manufacturing efficiency than on raw material costs, and although it may be true that in most industries there is now "a store of capacity for further expansion" of output, it would be most unwise to assume, on this account, that we can safely delay the resumption of investment in plant on a scale commensurate with our real needs.

Industrial Notes

THE ADDISON TOOL CO., LTD., inform us that they have moved to larger premises, with modern office, showroom, and warehouse facilities. The new address is Addison House, 28 Marshalsea Road, London, S.E.1 (telephone number, Hop 0577-8).

STANHOPE MACHINE TOOL CO., LTD., 5-17 Haverstock Hill, Chalk Farm, London, N.W.3, have been appointed sole distributors for the Mini-Head tapping attachment and the Britaulic air-hydraulic drilling unit for the counties of Middlesex, Berkshire, Surrey, Bedfordshire, Sussex, Essex, Herefordshire, Yorkshire, Lancashire and Cheshire.

LORANT ENGINEERS (LONDON), LTD., is the title of a new company which has been formed by Mr. H. J. Lorant. The address is 65 High Street, South Norwood, London, S.E.25, and the company holds sole agencies for a range of tools including the Suhner high-cycle portable tools for grinding, milling, polishing, brushing, sheet metal cutting, drilling, screw-driving, and similar operations.

TRAUB DEMONSTRATION VAN.—Elgar Machine Tool Co., Ltd., 172-178 Victoria Road, Acton, London, W.3, who are the sole distributors here for Traub single spindle and chucking automatics, inform us that a demonstration van, sent by their principals, is now in this country and will be available to visit the works of potential customers until May 10. Machines in the van are set up to produce various components which present features of interest.

INDUSTRIAL AND FACTORY LAW COURSE.—The legal groundwork necessary for industrial managers and executives will be covered in a 3-day course to be given on May 6, 7, and 8, by Mr. Harry Samuels, M.A., barrister-at-law, under the auspices of the Industrial Welfare Society. The course will be held at the Society's headquarters, Robert Hyde House, 48 Bryanston Square, London, W.1.

ASSOCIATION OF ENGINEERING DISTRIBUTORS, LTD., Hastings House, Norfolk Street, London, W.C.2.—Mr. C. D. Collingwood, managing director of Charles Baynes, Ltd., Knuzden Brook, Blackburn, was the principal guest at the second of the 1958 series of Council Luncheons, and in his speech he discussed the role of the engineering distributor as seen by a manufacturer. The luncheon was preceded by a meeting of the Executive Committee of the Association, and was followed by a Council meeting.

Corrections

In MACHINERY 92/793—4/4/58 it was stated that, with optical projection equipment and precision scales, co-ordinate setting on Mako type MH1000 milling machine can be made to 0.0004 in. We are informed by the agents, Mortimer Engineering Co., that this should have read, 0.00004 in.

In MACHINERY, 92/846—11/4/58, in an article entitled "A Modern Swedish Steelworks," it was stated that the equipment of the melting shop of the firm concerned—Nyby Bruks A-B., Nybybruk, Eskilstuna, Sweden—"comprises two electric arc furnaces with capacities of 14 and 16 tons, and a high frequency induction furnace with two crucibles, each with a capacity of 5 tons." This should read "two electric arc furnaces with capacities of 14 and 16 tons, and two high frequency induction furnaces with four crucibles, one of 3 tons, two of 5 tons, and one of 8 tons capacity." Also, for "Hocker process" and "Hocker Electrochemical Corp.," read "Hooker process" and "Hooker Electrochemical Corp."

Books Received

BRITANNICA BOOK OF THE YEAR, 1958 (covering the events of 1957). Edited by John Armitage. Encyclopaedia Britannica, Ltd., 11 Belgrave Road, London, S.W.1. 544 pp. [Price from £5 5s. according to the binding.]

In this well-known annual publication, which is the tenth post-war edition, the field covered by more than 400 contributors is, as usual, very wide, so that it constitutes a most valuable work of reference. There are 502 articles in all, and among the subjects with which they are concerned may be mentioned armaments, aviation, education, engineering, industry, and telecommunications.

Coming Events

INSTITUTION OF ENGINEERING DESIGNERS.—April 24, at 6.45 p.m., at the Institution, 38 Portland Place, London, W.1; paper on "Some Aspects of Weight Control in Design," by J. McLaughlin and F. Howarth.

INSTITUTION OF ENGINEERING INSPECTION. *North-Western Branch.* April 24, at 7.30 p.m., at the Engineers' Club, Albert Square, Manchester; paper on "The Principles of Gauge Design," by W. H. Foster.

INSTITUTION OF MECHANICAL ENGINEERS. *London Graduates' Section.* April 24, at 6.30 p.m., at the Institution, 1 Birdcage Walk, S.W.1; paper on "Some Methods of Manufacture and Application of Flexible Metallic Tubing," by C. Bateman.

Scrap Metals

†LONDON.—‡Prices per ton for non-ferrous scrap metals free from iron are as follows:—clean copper wire, untinned and free from lead and solder, £135; clean heavy copper, untinned and free from lead and solder, £128; second grade copper wire, £122; clean light copper £119; braziery copper, £108; gunmetal, £115; brass mixed, £80; lead, net, £58; zinc, £27; cast aluminium, £84; old rolled aluminium, £112; battery lead, £31; unsweated brass radiators, £66; hollow pewter, £495; black pewter, £365.

MIDLANDS.—The general position as regards trading in ferrous scrap has not changed during the past two weeks. Midland merchants are restricting their buying as it is extremely difficult to place scrap forthcoming under running contracts, let alone other miscellaneous supplies. Practically all grades are restricted, and deliveries can only be made against allocations. Heavy steel outlets are insufficient to permit of clearing all the material available, and many merchants find it necessary to store compressed bundles. The movement of steel turnings and cast iron borings, although curtailed, is more lively, and blast furnaces are taking good deliveries. Bushy turnings are still difficult to place, and the outputs of the smaller factories are not being cleared as regularly as hitherto.

The price paid by consumers for hydraulically-compressed destructor bundles has now fallen well below the maximum control figure, and merchants have reduced their prices for bundles by about 30s. to 40s. per ton. Destructor scrap in loose form is moving very slowly to merchants' yards, as stocks are already very high. Foundry demand for short steel and cast iron is falling, and allocations can be filled without difficulty. Indeed, unless more scrap is wanted in the near future, merchants will have to consider stopping their shears for at least part of each week.

Opinion in the steelmaking industry is, in general, optimistic as regards the future, as is evident from the fact that the steelworks are taking scrap at the present time, although their stocks are very high. Meanwhile, merchants must be content to ensure that clearances are made in respect of their works contracts as regularly as possible, with the hope that not too much scrap need be put into stock.

Current maximum control prices, delivered consumers' works, are now: *Heavy steel No. 1, 217s. 6d.; *heavy steel No. 2, 196s.; *heavy steel No. 4, 207s. 6d.; *heavy steel No. 5, 195s. 6d.; light iron No. 8, 149s.; short turnings No. 9 (free from alloy), 167s. 3d.; light steel No. 11, 164s. 3d.; bushy turnings, 117s.; short alloy turnings, 160s. 9d.; short steel No. 2, 233s. 3d.; machinery cast, 233s.

Prices may be increased up to 2s. 6d. per ton according to quantities tendered over a given period.

* For use by Round Oak Steelworks, Brierley Hill, increase by 1s. 6d. per ton.
† George Cohen, Sons & Co., Ltd., Commercial Road, E.14.
‡ Subject to market fluctuations.

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18/4/58

Personal

MR. W. J. WESTON, Assoc.I.E.E., M.Amer.I.E.E., M.A.M.E.M.E., has been appointed Birmingham Area manager for Lancashire Dynamo Group Sales, Ltd.

MR. H. T. CUMMINGS of Joseph M. Cummings has retired after a very long association with Barr Thomson & Co., Ltd., Netherton Iron Works, Kilmarnock. In future Mr. Ernest H. Slater will represent the company in the counties of Northumberland and Durham. He will operate from Bamford, nr. Sheffield, with a district office at 13A Kent Road, Harrogate.

MR. GRANVILLE HORSLEY has been appointed a director of Crofts Engineers (Holdings), Ltd., also joint managing director of Crofts (Engineers), Ltd., Bradford, 3.

MR. C. H. FLURSCHEIM, B.A., M.I.E.E., Mem.A.I.E.E., chief electrical engineer of Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17, has been appointed a director of the company.

Machine Tool Share Market

The strength and activity of British Funds and similar fixed interest stocks provided the outstanding feature of the past week in stock markets.

Except in this section, business showed no appreciable expansion. A firm undertone was, however, maintained in almost all markets, and price movements were mainly favourable.

Although quiet conditions prevailed in the industrial market, the general tone strengthened steadily under the influence of the upward trend in gilt-edged securities, and numerous improvements were shown on balance.

Among machine tool issues, Asquith Machine Tool advanced 1s. to 17s. 6d.; Birmingham Small Arms, 1s. to 25s.; British Oxygen, 6d. to 34s. 6d.; Coventry Gauge & Tool, 6d. to 13s. 3d.; Ambrose Shardlow, 6d. to 32s. 6d.; Churchill Machine Tool, 3d. to 17s. 9d.; Firth Brown Tools, 3d. to 12s. 6d.; Samuel Osborn, 3d. to 16s. 6d.; and John Shaw & Sons (Wolverhampton), 1½d. to 11s. 9d. On the other hand, Armstrong Stevens lost 4½d. at 6s. 7½d.; Broom & Wade, 4½d. at 9s. 4½d.; Arnott & Harrison, 3d. at 13s. 9d.; Brooke Tool, 6d. at 5s.; Jones & Shipman, 6d. at 20s. 9d.; and Tap & Die Corporation, 3d. at 7s. 6d.

SAMUEL OSBORN & CO., LTD.—Interim dividend, 7½ per cent.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	9d.
Armstrong, Stevens & Son, Ltd.	Ord.	5/-	6 7½
Allen (Edgar) & Co., Ltd.	Ord.	£1	28/3
" " "	5% Prf.	£1	14/6*
Arnott & Harrison, Ltd.	Ord.	4/-	13/9
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	17/6 ex rights
" " " "	6% Cum. Prf.	£1	17/9
Birmingham Small Arms Co., Ltd.	Ord.	£1	25/-
" " "	5% Cum. "A" Prf.	£1	15/6
" " "	6% Cum. "B" Prf.	£1	17/6
" " "	4% 1st. Mort. Deb.	Stk.	85/-
British Oxygen Co., Ltd.	Ord.	£1	34/6
" " "	6½% Cum. Prf.	£1	21/6
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	5/-
Broom & Wade, Ltd.	Ord.	5/-	9/4½
" " "	6% Cum. Prf.	£1	17/9
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	14/4½
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/6
Butler Machine Tool Co., Ltd.	Ord.	5/-	6/3
" " "	5% Cum. Prf.	£1	13/9
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red. Cum. Prf.	£1	13/9
Churchill (Charles) & Co., Ltd.	Ord.	2/-	4/6
" " "	6% Cum. Prf.	£1	26/3†
Churchill Machine Tool Co., Ltd.	Ord.	5/-	17/9
" " "	6% Cum. Prf.	£1	18/9
Clarkson (Engrs.), Ltd.	Ord.	5/-	11/-xd
Cohen (George), Son & Co., Ltd.	Ord.	5/-	11/6
" " "	4½% Cum. Prf.	£1	14/6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	13/3
" " " "	5% Cum. Red. Prf.	£1	16/3
Coventry Machine Tool Works, Ltd.	Ord.	4/-	9/-
Craven Bros. (Manchester), Ltd.	Ord.	5/-	6/-
Elliott (B.) & Co., Ltd.	Ord.	1/-	3/-
" " "	4½% Red. Cum. Prf.	£1	13/9
Export Tool & Case Hardening Co., Ltd.	Ord.	2/-	1/6
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/6
Greenwood & Batley, Ltd.	Ord.	£1	46/10½
Harper (John) & Co., Ltd.	Ord.	5/-	14/-
" " "	4½% Red. Cum. Prf.	£1	13/1½
Herbert (Alfred), Ltd.	Ord.	£1	62/6
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	10/6
" " "	"B" Ord.	5/-	9/9
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	20/9
" " " "	7% Cum. Prf.	5/-	5/-
Kayser, Ellison & Co., Ltd.	Ord.	£1	45/-
" " "	6% Cum. Prf.	£1	18/3
Kendall & Gent, Ltd.	Ord.	5/-	7/9
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	6/6
Kitchen & Wade, Ltd.	Ord.	4/-	10/3
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/4½
Massey, B. & S., Ltd.	Ord.	5/-	7/3
Modern Engineering Machine Tools, Ltd.	Ord.	5/-	10/-
Newall Engineering Co., Ltd.	Ord.	2/-	5/-
Newman Industries, Ltd.	Ord.	2/-	2/6
" " "	6% Prf. Ord.	5/-	5/6
Noble & Lund, Ltd.	Ord.	2/-	4/9
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	16/6
" " "	5½% Cum. Prf.	£1	24/6
Pratt (F.) & Co., Ltd.	Ord.	5/-	20/6
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	5/3
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	32/6
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	11/9
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	35/-
" " " "	5% Cum. Prf.	£1	15/-
Stedall & Co., Ltd.	Ord.	5/-	4/6
Tap & Die Corporation, Ltd.	Ord.	5/-	7/6
" " "	4½% Deb. 1961-1977	Stk.	82/-
Wadkin, Ltd.	Ord.	10/-	18/9
Ward (Thos. W.), Ltd.	Ord.	£1	75/-
" "	5% Cum. 1st. Prf.	£1	15/6
" "	5% Cum. 2nd Prf.	£1	24/9
Willson Lathes, Ltd.	Ord.	1/-	2/4½

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Birmingham price.

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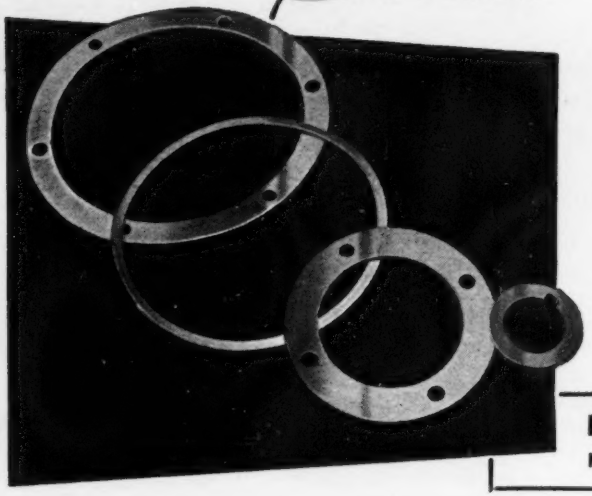

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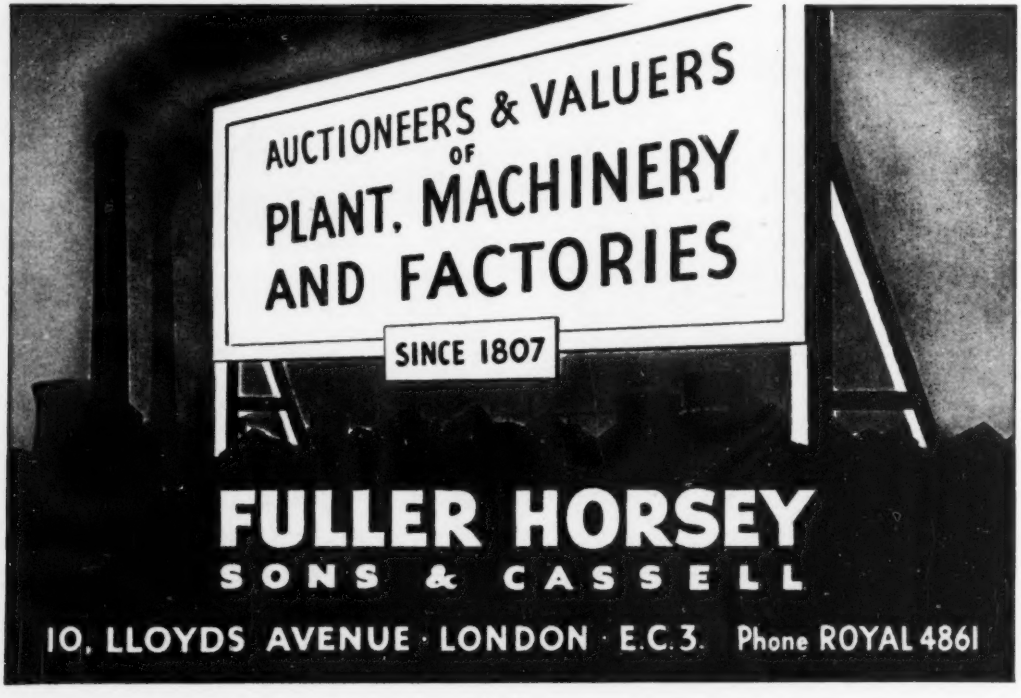

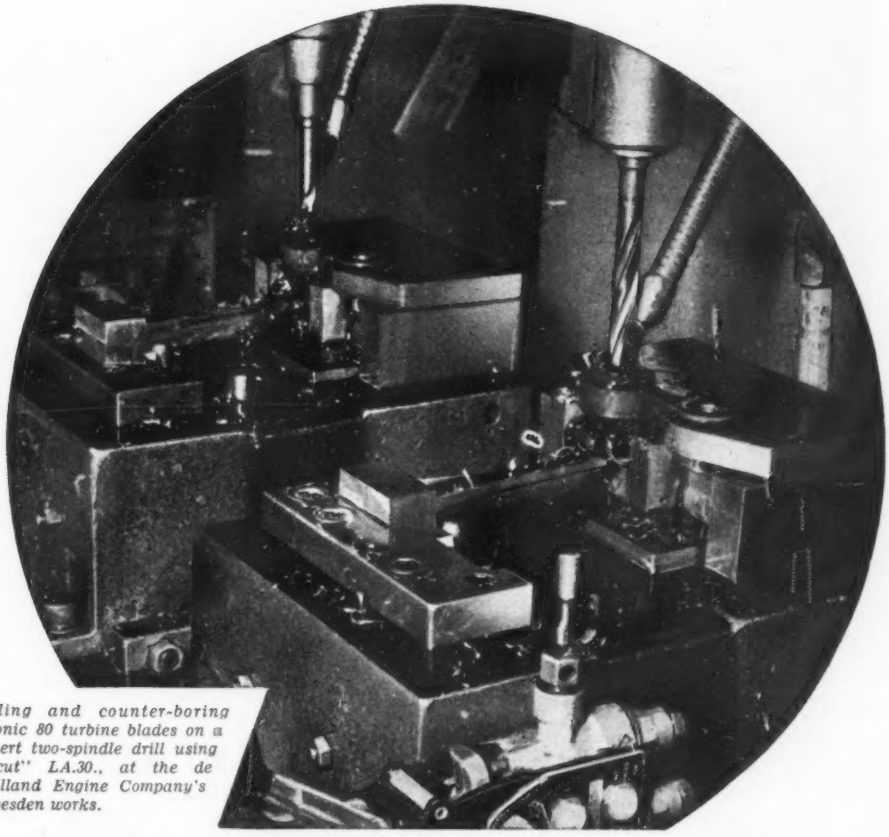

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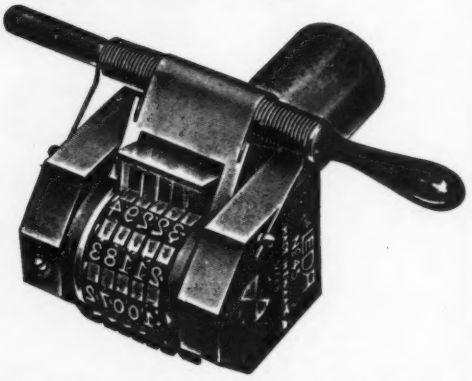

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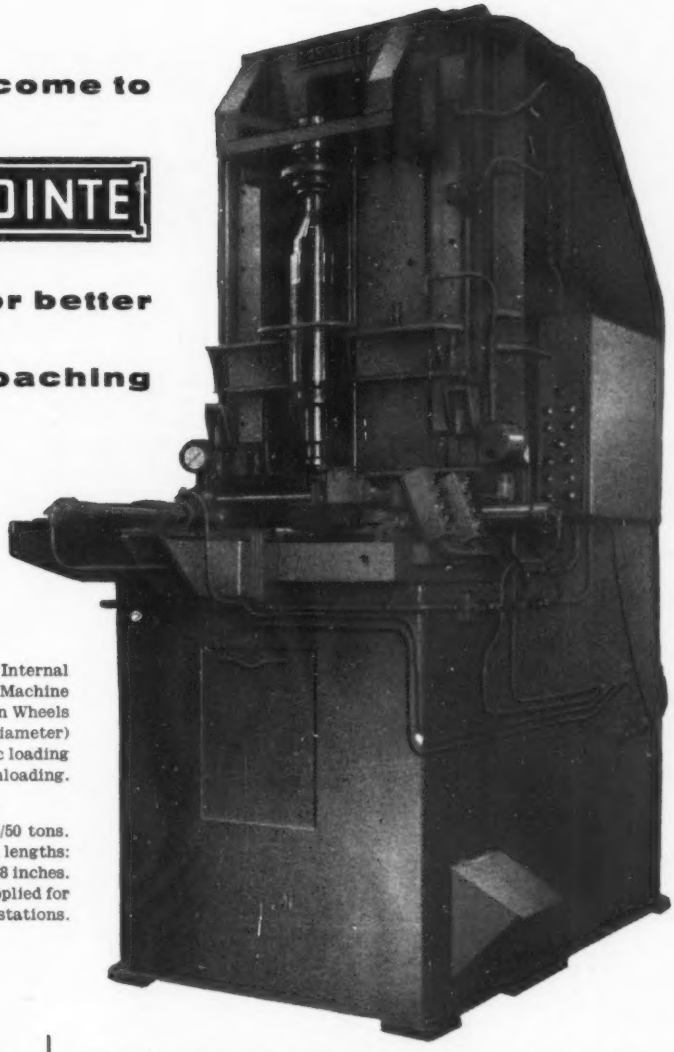

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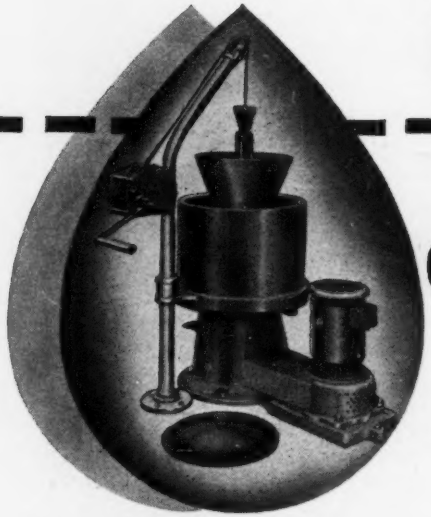

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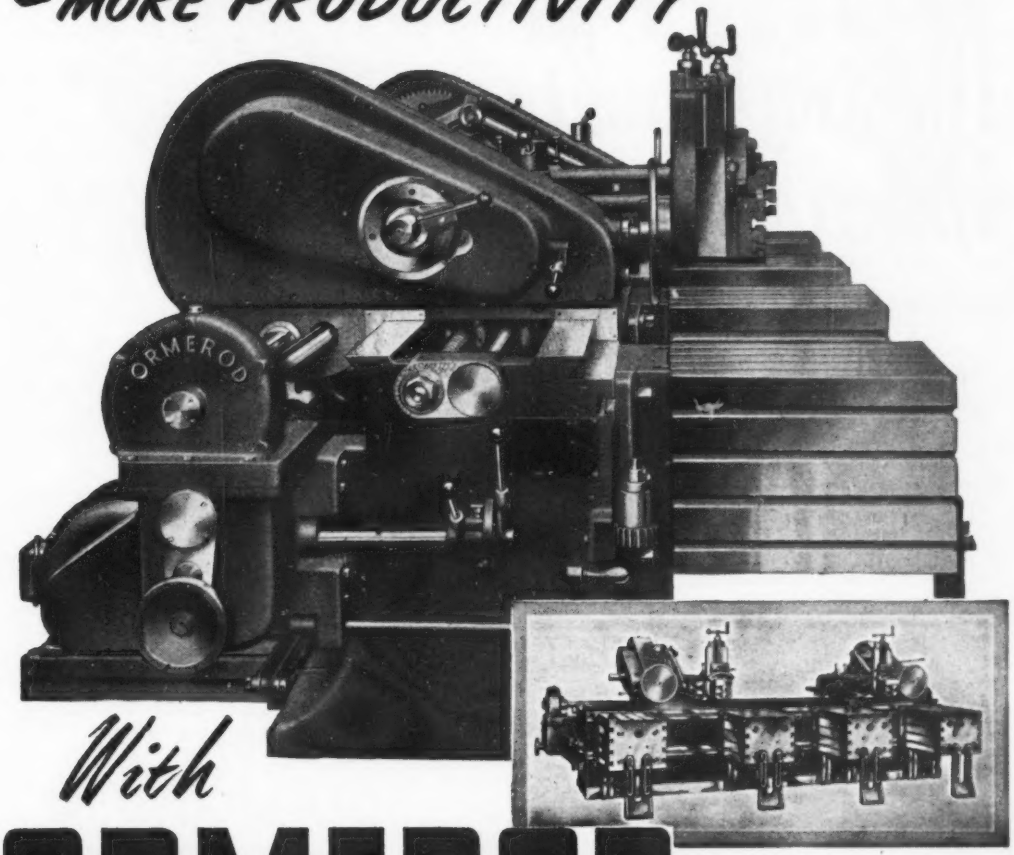

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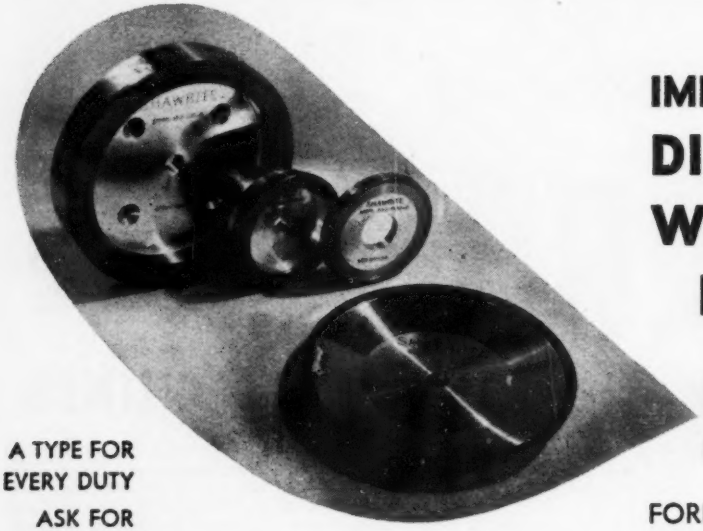

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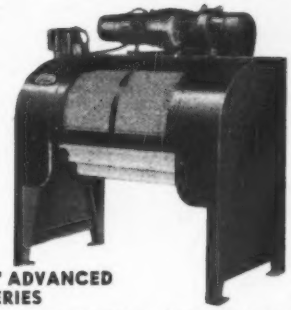
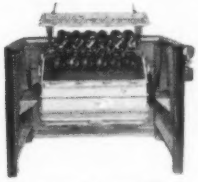


Model DB 200

ALMCO'S "ADVANCED DESIGN" SERIES

Thirteen great models in this series! These machines feature a wide range of variable speeds (infinite from 6 to 30 r.p.m.), making possible economical deburring and finishing of the greatest variety of parts. Each unit has Almco's exclusive design features and rugged construction to stand up under all types of punishing applications.

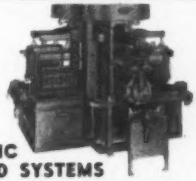


"FIXTURE" TYPE BARRELS

Pioneered by Almco for processing large and intricate parts. Custom designed fixtures hold parts securely, prevent part-on-part impingement and allow abrasive action to reach all surfaces, cavities, slots, etc. Barrels have automatic forward and reverse controls.

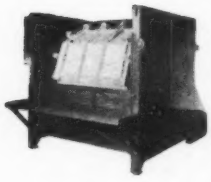
MULTI-COMPARTMENT BARRELS

Do you have these deburring and finishing problems—wide variety of parts or small quantity runs where fixtures would be too costly? Lack of floor space for several machines? An Almco custom-designed multi-compartment barrel may give you a cost-saving answer. Automatic forward and reverse. Any combination of compartments and doors.



SUB-O-MATIC AUTOMATED SYSTEMS

Almco's exclusive submerged unit is an automatic, "assembly line" system for micro-precision deburring and finishing of small parts in quantity. Saves labour, speeds up processing and flow of high production parts. One man can operate this equipment and handle as many as 192 barrel loads per 16 hr. day. Slashes compound expense to minimum. These submerged systems can also be obtained in non-automated, straight line systems.



CUSTOM-DESIGNED BARRELS

Almco designs and manufactures special barrels of all types for problems where standard equipment cannot be effectively used. These range from the smallest type to the largest fixture barrel such as the 60" diameter x 60" length barrel shown above. Special large diameter barrels with double flat or triple flat doors are also available to accommodate extra large parts and to allow abrasive media to flow freely over the outer periphery of the part. Your special problems may be solved with one of Almco's custom-designed barrels.

Model DB 01A

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Twin barrel machines manufactured by Almco are the standard of the industry for processing small lots of parts and for companies with large lots of small parts. Also ideal for sample processing, barrel finishing research and development work. These units are Almco engineered to the highest specification standards and include operational and safety features found on larger Almco machines.

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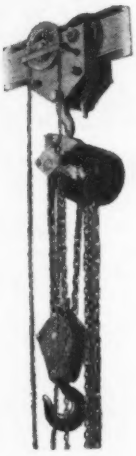

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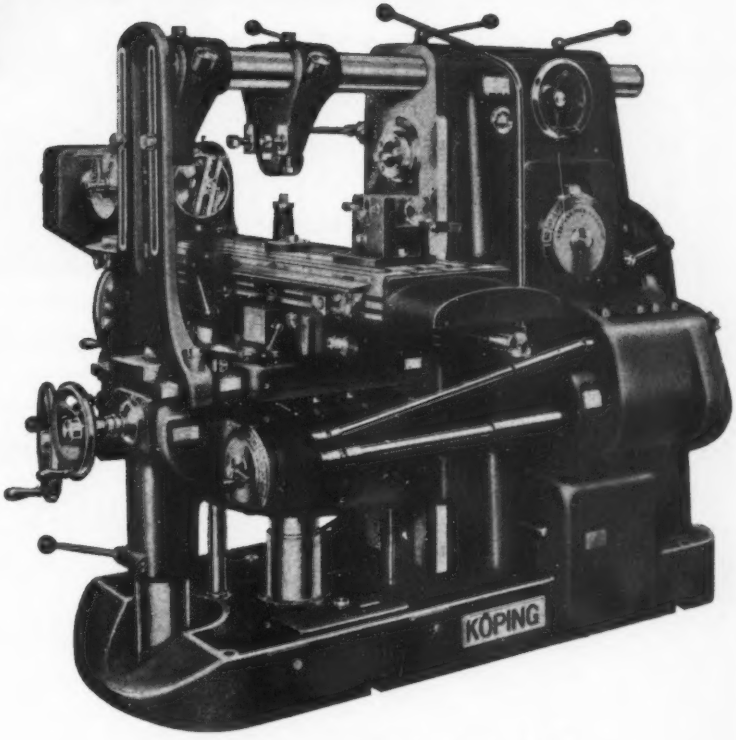

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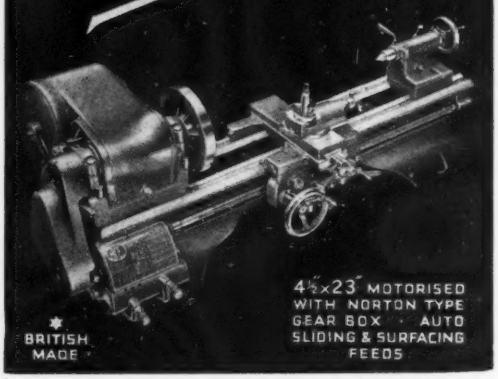

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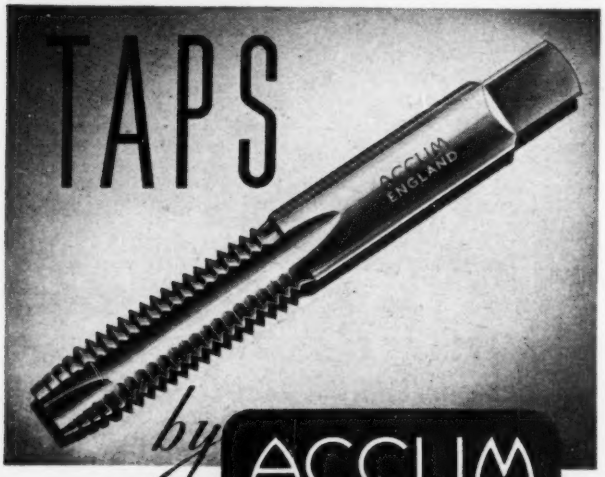

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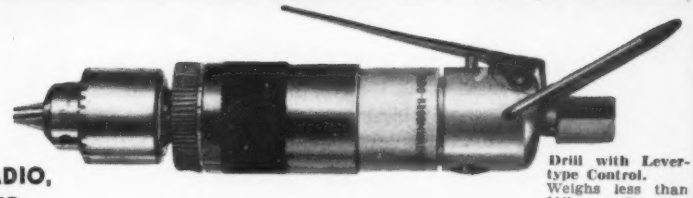

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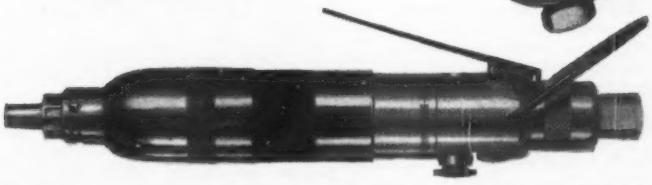

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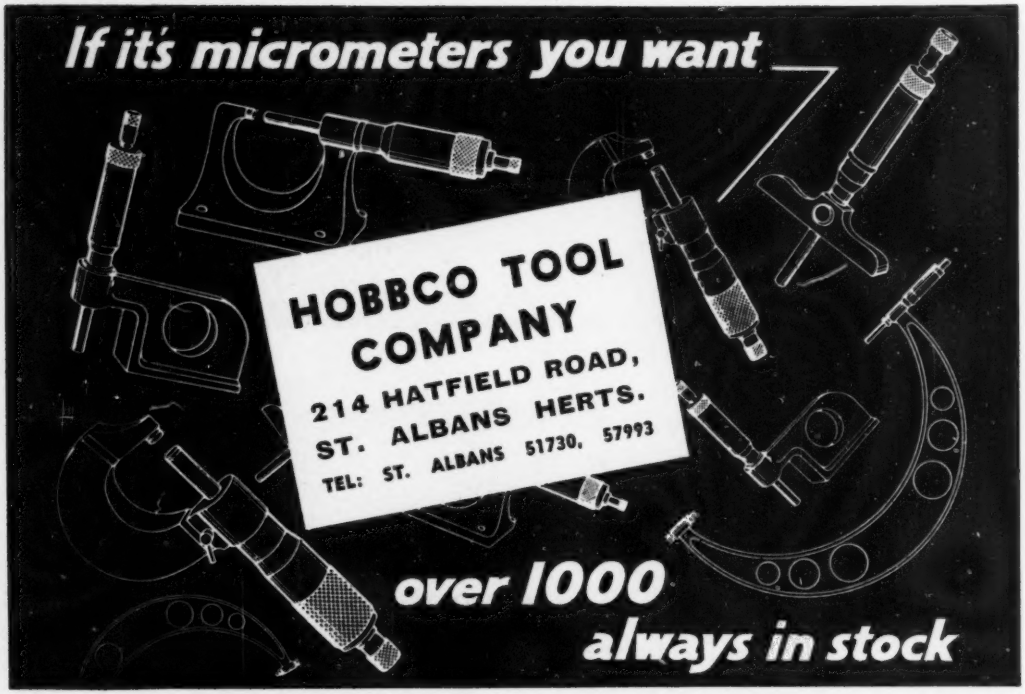

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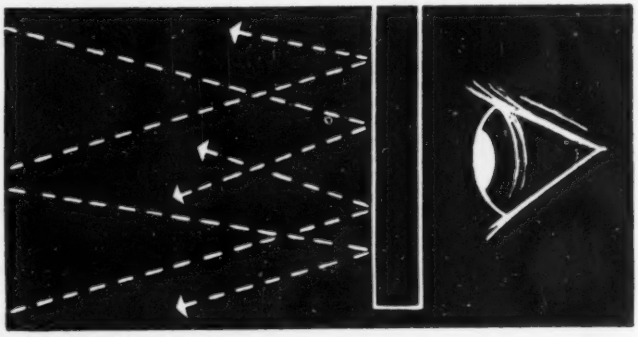

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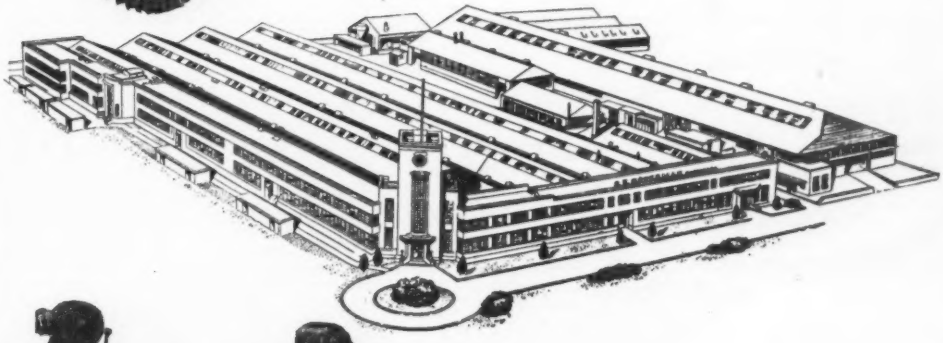

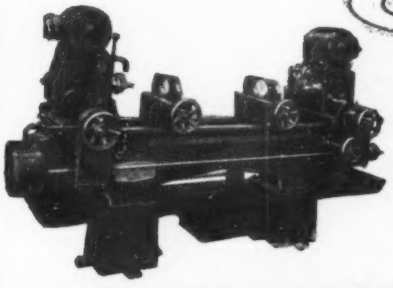

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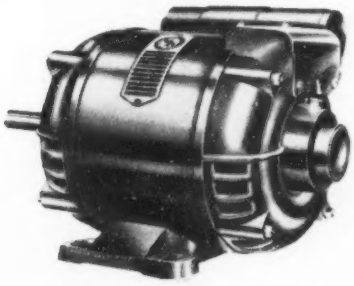

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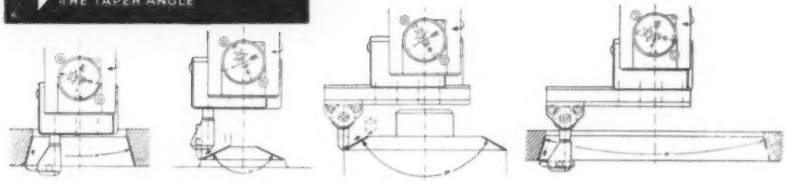

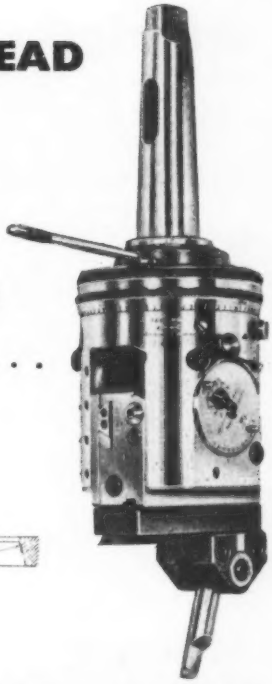

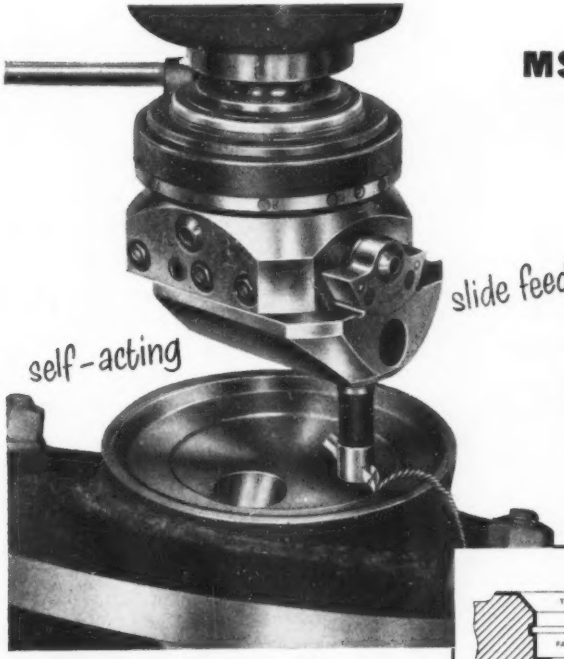

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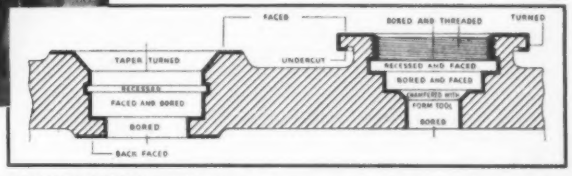

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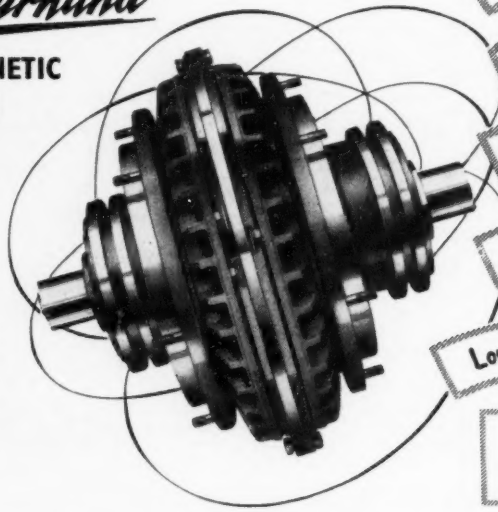

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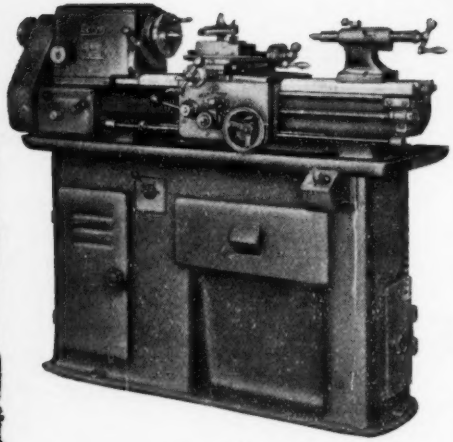

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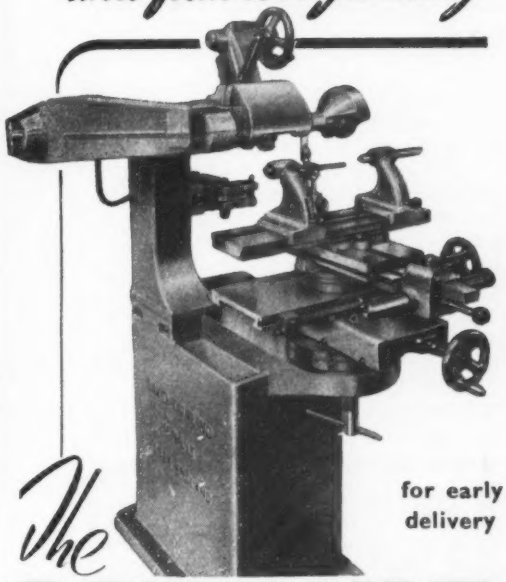
to handle all cutter and form tool grinding



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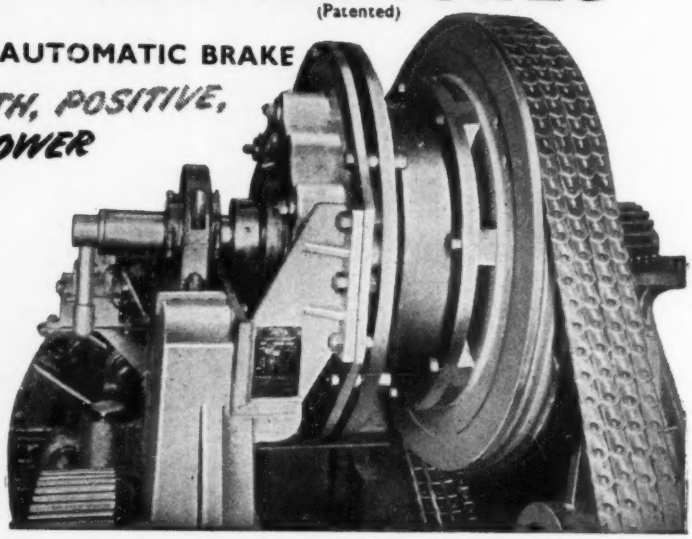

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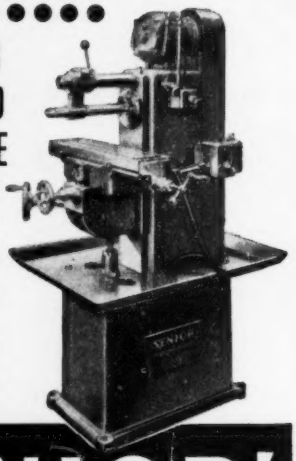

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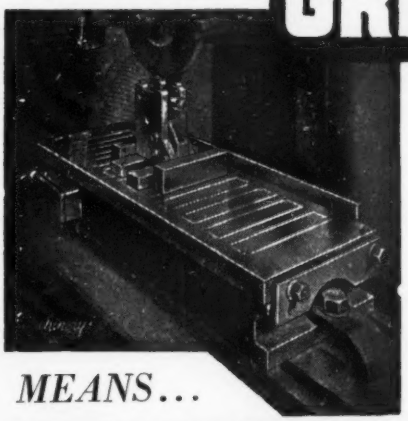

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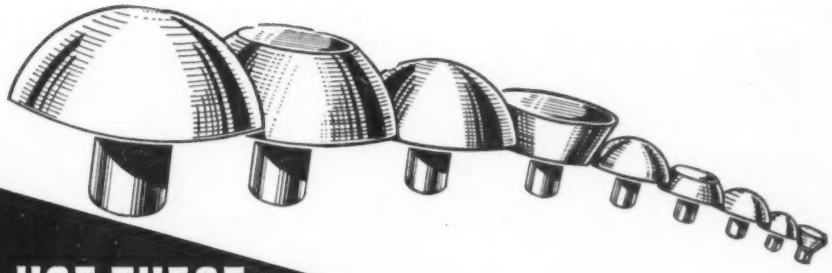

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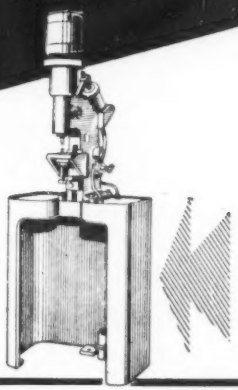

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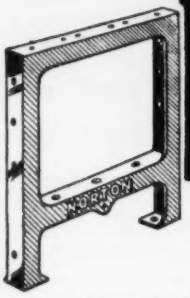

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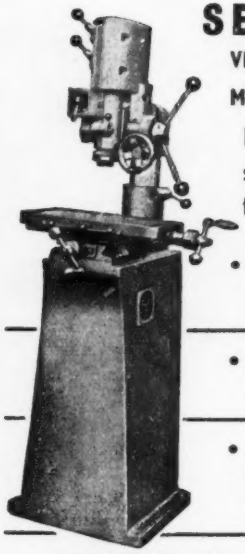

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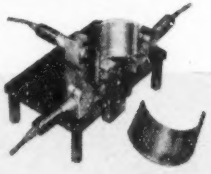

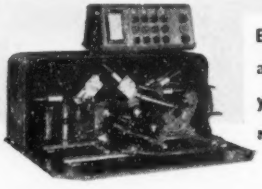

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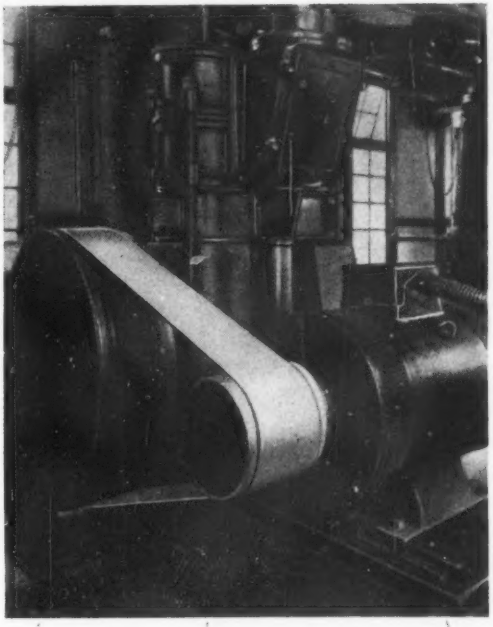

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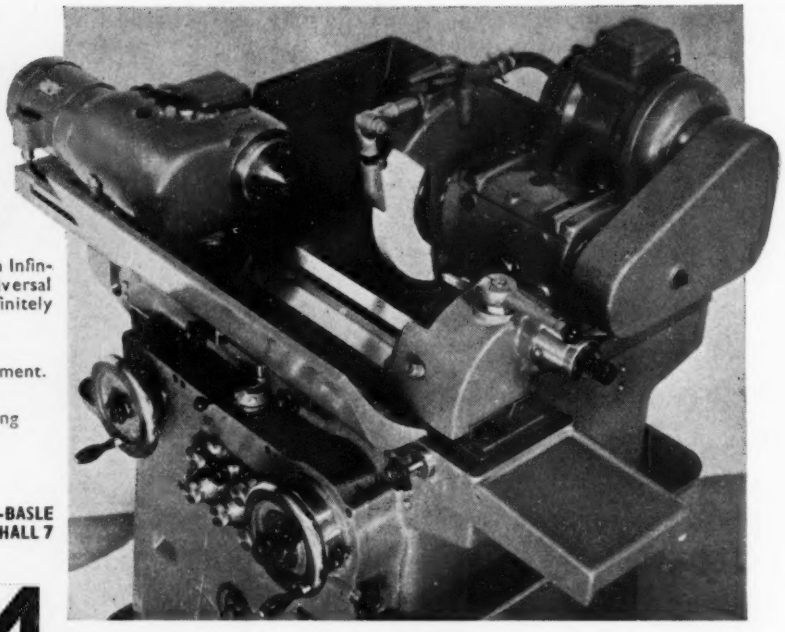

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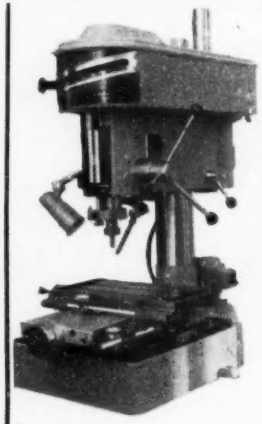

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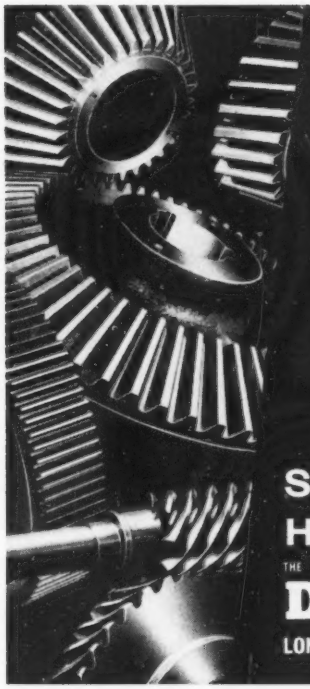

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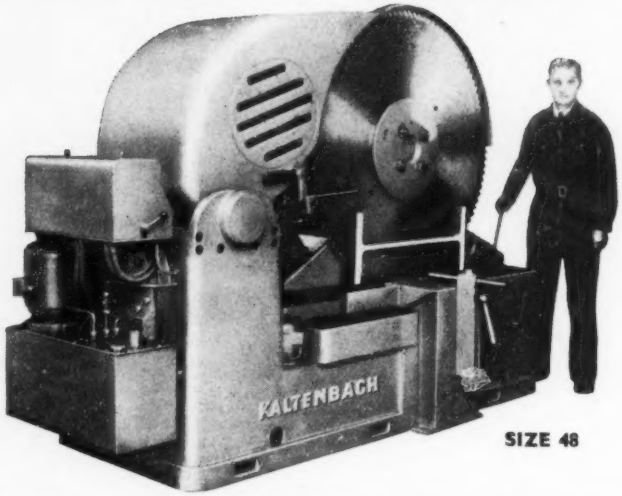

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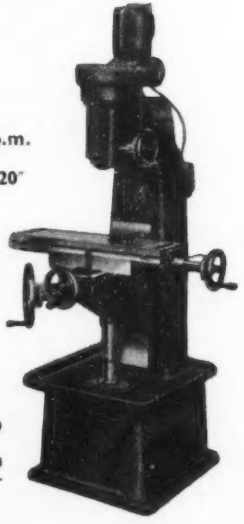

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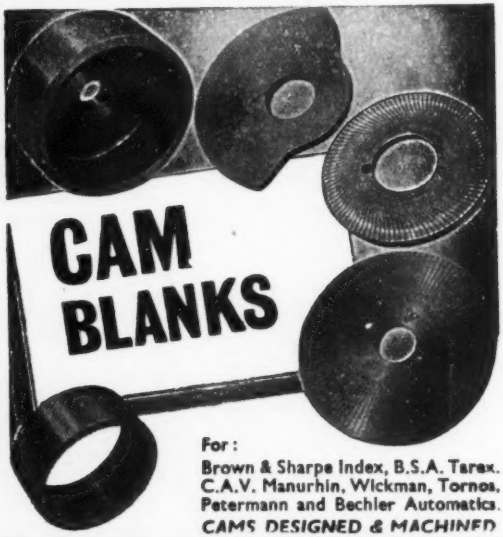

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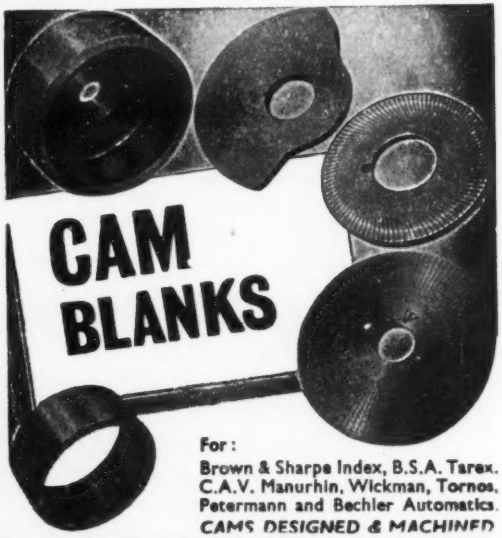

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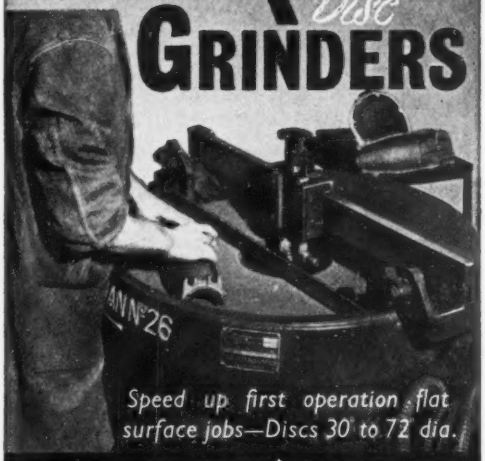

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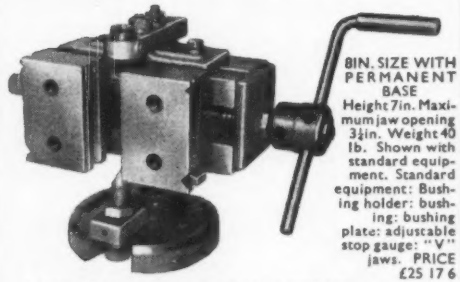

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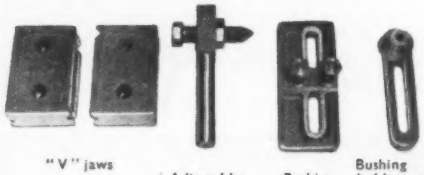

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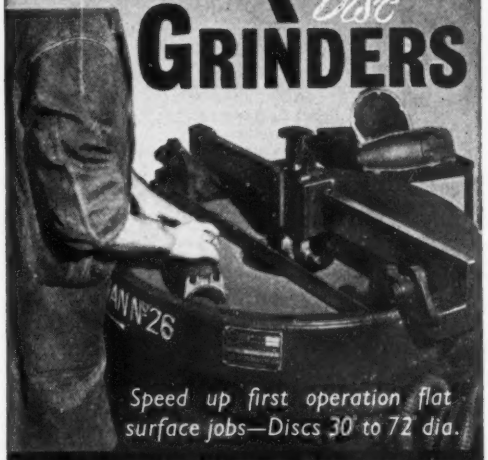

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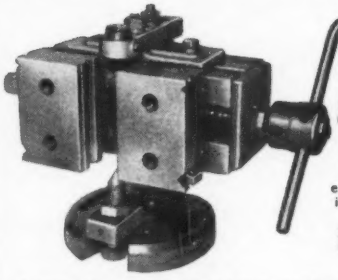

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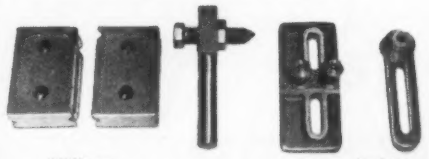

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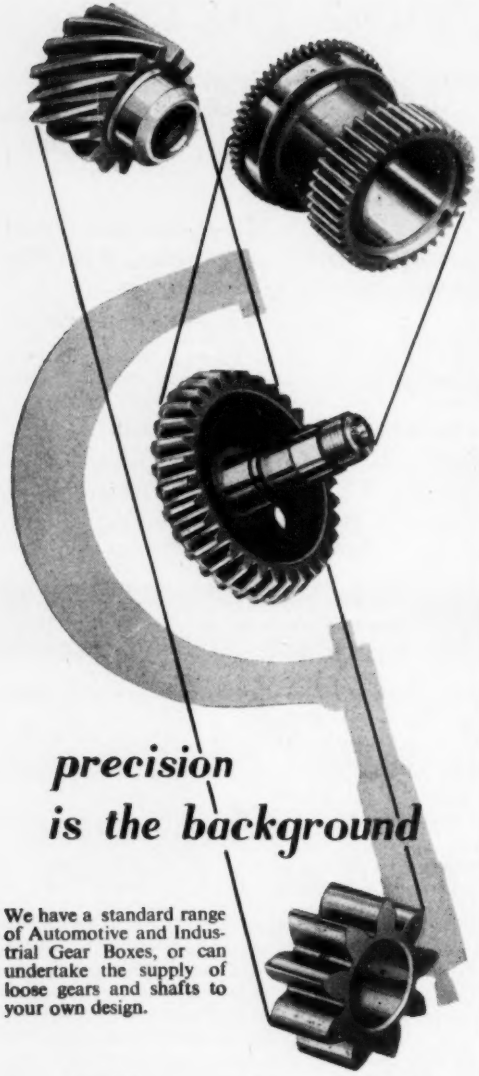

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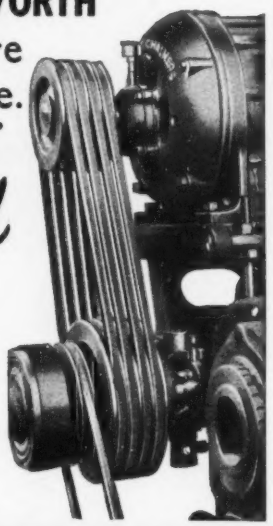

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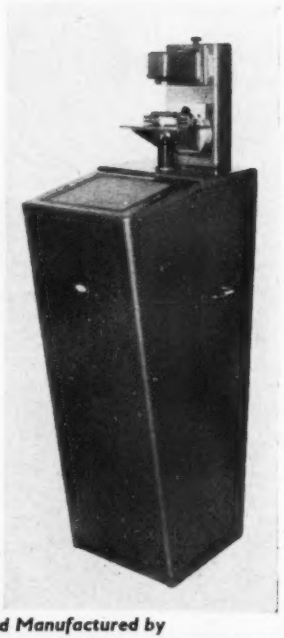

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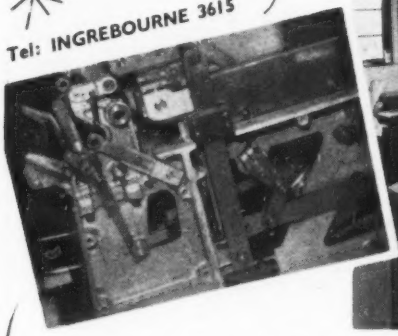

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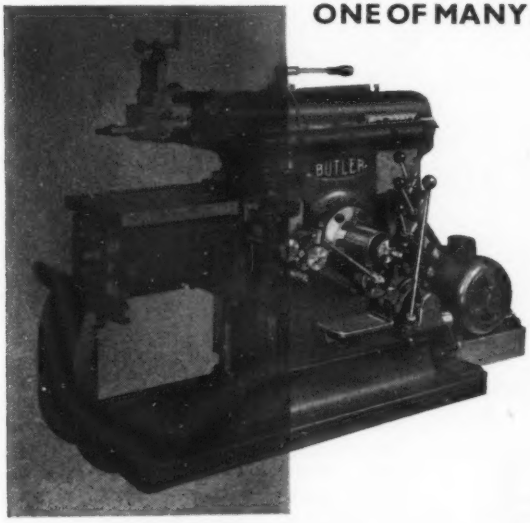

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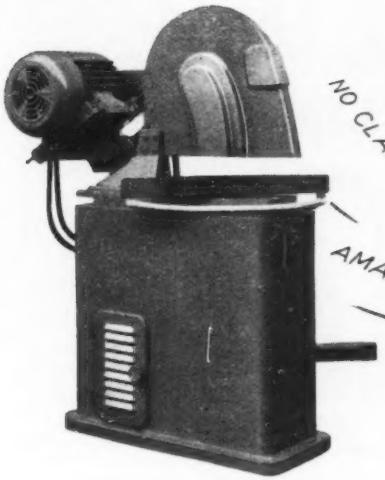

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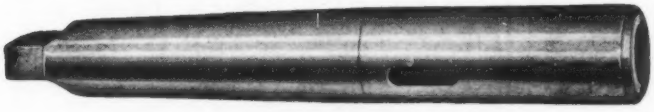

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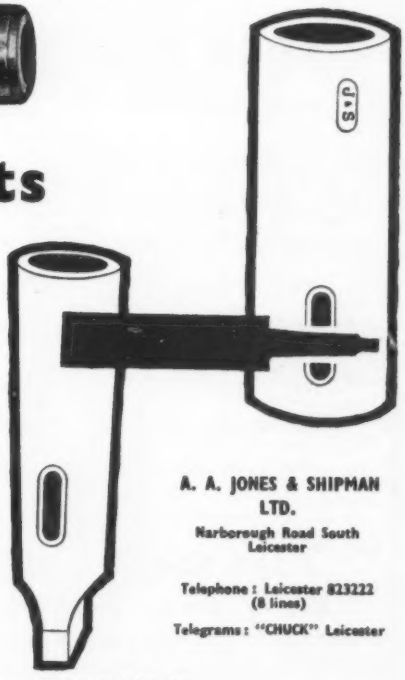

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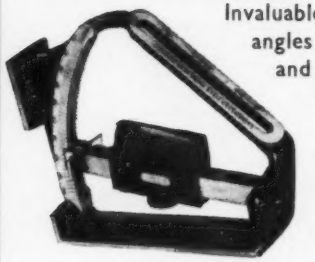

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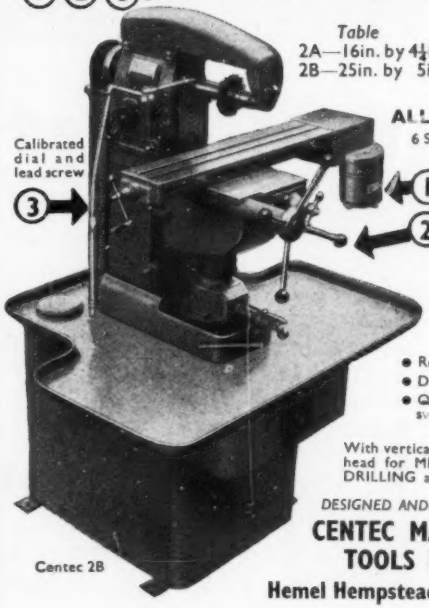

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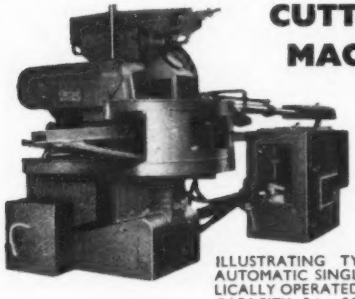

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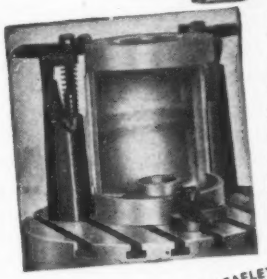

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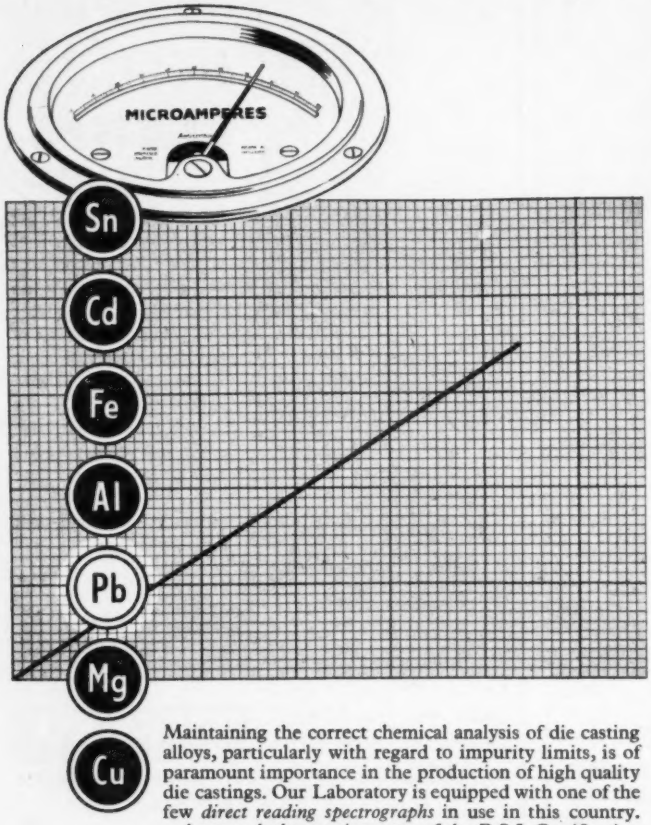

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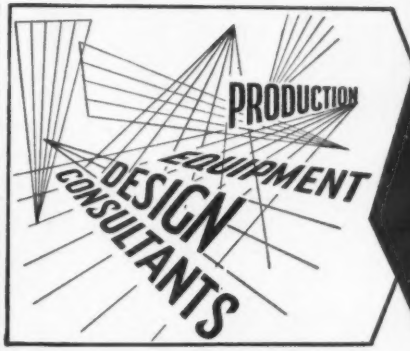

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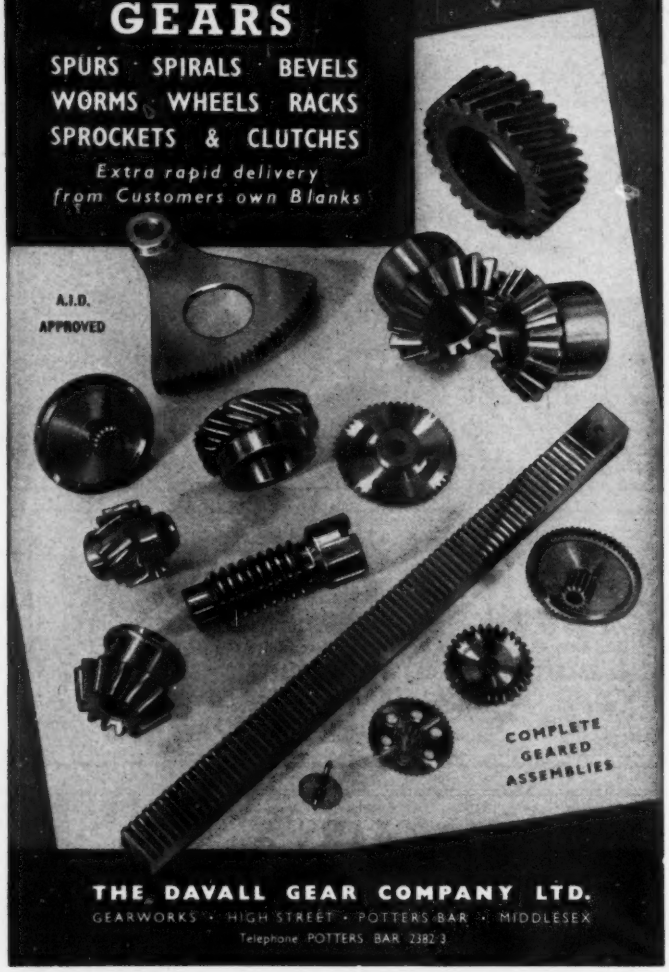

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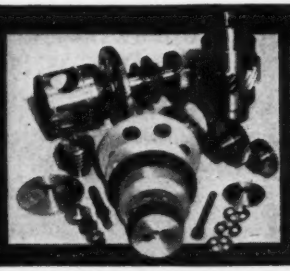

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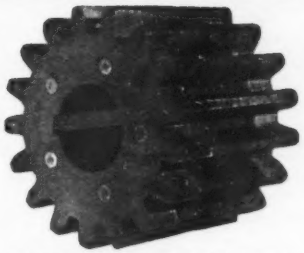

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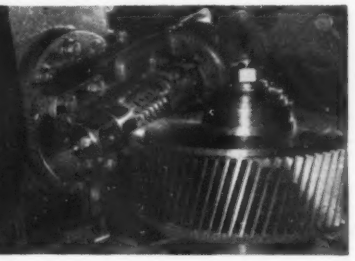

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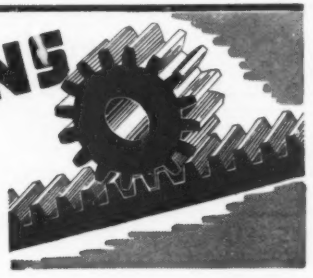

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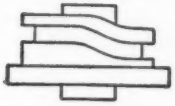

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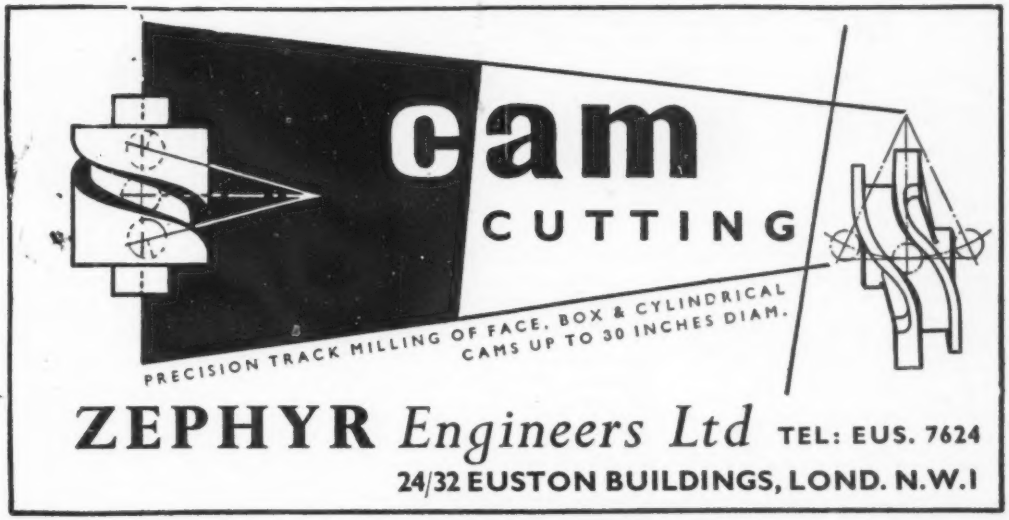

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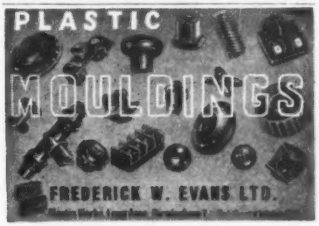

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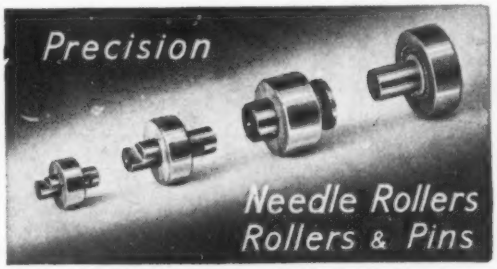

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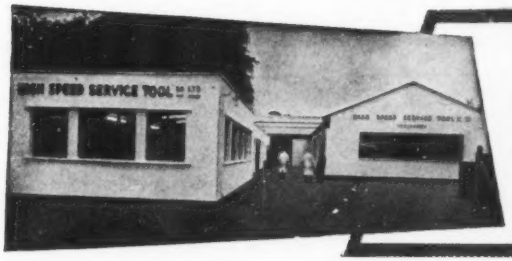

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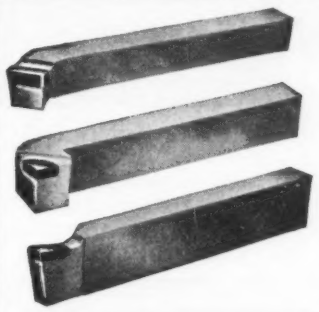

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Classified Advertisements (*PLANT WANTED, contd.*)

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Traverse	24in.
Size of Table ...	39in. by 34in.
Rotates through	360 deg.
Max. distance spindle to table ...	35in.
Longitudinal traverse	51in.
Cross traverse	32in.
Max. distance facing head to outer support	88in.
Approximate weight ...	6½ tons

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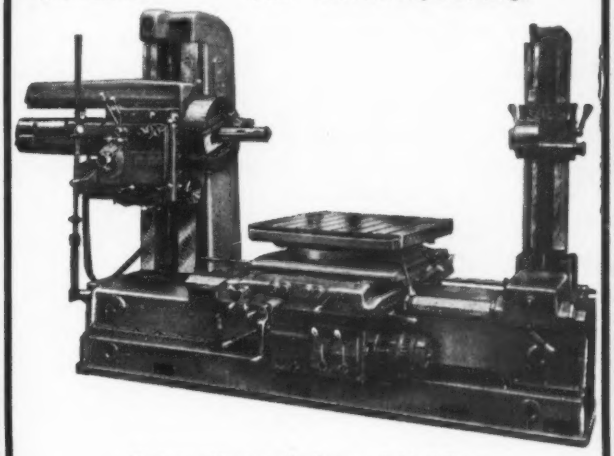

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Progress 4E Drilling Machine. £140.
Parkson Horizontal Milling Machine. Table 51in. by 11in. overall. £195.
Kitchen & Wade 5ft. Radial Drill. £800.
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Jos. Heap 1in. Tangential Screwing Machine. £165.
Ward OE Capstan. Bar feed. £165
Hardinge Precision Lathe, 5in. £37 10s.
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For immediate delivery,

14½in. centre by 16ft. bed. Admit 9ft. 9in. between centres, hollow spindle 4½in. dia. swing 52in. dia. by 17in. wide in gap. NEW 16½in. CENTRE DITTO. 24ft. bed, to admit 17ft. 9in. between centres, 4½in. hollow spindle, swing in gap 61in. by 18½in. wide.

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DIMCO

10½in. MITCHELL S.S. & S.C. Lathe, 5ft. b.c.
NO. 4 CINCINNATI Plain Miller. Dial type.
No. 2 CINCINNATI Plain Miller. Dial type.
25 R.V.M. KENDALL & GENT Vertical Miller.
No. 2M CINCINNATI Vertical Miller.
No. 1 KEARNS Horizontal Borer. Facing head and spindle.
No. 7 WARD Bar Feed Capstan. Covered bed.
3A WARD Bar Feed Capstan. Overhauled.
No. 8 WARD Combination Turret Lathe.
540 JONES & SHIPMAN Surface Grinder.
6 × 18 THOMPSON Toolroom Grinder. Type F.
10in. × 24in. NEWALL Universal Grinder
CHURCHILL HBY Internal Grinder.
No. 3 WARNER & SWASEY Capstan.
Nos. 3 and 5 GISHOLTS. Bar feed.
24in. DEAN, SMITH & GRACE Boring and Facing Lathe.
4in. Spindle UNION Model BFT.100.
1S, 2S, 2D, 2B, 4B HERBERTS. TO CLEAR, CHEAP.
PLATE Drilling Machine, 2 spindle, No. 5 M.T.
24in. BULLARD Vertical Borer.
4in. B.S.A. Auto. Long Stroke. Slotting attachment.

DIMCO (Gt. Britain) LTD.
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Electric Motors, New and Secondhand, over 1,000 always available for sale, part exchange or hire. Prompt repairing service in event of breakdown.—JOHN RODWELL, LTD., Vicarage Road, Hornchurch 8877/8.

Natco Multi Spindle Driller, 12 spindles, No. 1 M.T. Table 20in. by 20in. R. & F. head. Motorised.—WILCOX & CO., Barr Street, Birmingham, 19. NORthern 1234/5.

C·E·M

New **BENTLEY** Plate Bending Rolls, 6ft. × ¼in., 8ft. × ⅜in. and 8ft. × ¼in. Heavier capacities and lengths for early delivery. All Machines fitted with opening end frame and self-supporting top roll. Up to the minute design to give high output at reasonable prices. Quotations and fully illustrated literature gladly supplied.

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Classified Advertisements (*PLANT FOR SALE, contd.*)

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ACME-GRIDLEY, Type R, 4-spindle, ⅞in. capacity.
ACME-GRIDLEY, Type R, 4-spindle, 1⅛in. capacity. (2 machines.)
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RYDERMATIC No. 12 Multi Tool Lathes.

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BROWN & SHARPE No. 2 Surface Grinder.
NORTON Surface Grinder, hydraulic, 18in. by 6in.
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LANDIS 10in. by 18in. Plain Grinder.
JONES & SHIPMAN 10in. by 27in. Semi-Universal.
CHURCHILL 24in. by 10in. Universal.
PRECIMAX Type UPJ 12in. by 36in. Universal.
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MURAD ⅜in. Capstan Lathes (2).
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GISHOLT No. 4 Friction Head Capstan.
LIBBY 4R 2in. Capstan Lathe. Bar feed.
BARDONS & OLIVER No. 5 Capstan Lathe.
HERBERT No. 7 Turret Lathe.
FOSTER No. 2B Turret Lathe.

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New BOXFORD 4¼in. Type A.
New COLCHESTER CHIPMASTER, 5in. by 20in.
SOAG OXFORD 6½in. Centre Lathe.
SOUTHBEND 13in. swing taper turning.
WILLSON 8½in. A.G.H. Lathe.
CARDIFF 8½in. by 48in. Lathe.
New COLCHESTER ASCOT 8½in.

MILLERS.

New CHRISTEN Swiss Universal Tool and Die Mill.
HERBERT No. 1 Horizontal.
New VICTORIA U1 and U2 Universal.
ARCHDALE 20in. Horizontal Mills (3).
ARCHDALE 28in. Horizontal Mill.
OLIVETTI FP2 Manufacturing Miller. Table 52¾in. by 14¼in. Longitudinal traverse 39¾in.
New GRAFFENSTADEN Model GH3 Plain Horizontal, table size 67¾in. by 16½in.
New TAYLOR Vertical, table 17¾in. by 5½in.
RICHMOND VHM Vertical Mill.
New VICTORIA V2 Vertical.
New GRAFFENSTADEN FV.102 Vertical Mill. Table 51in. by 11¾in.; 39¾in. longitudinal traverse.
HOLROYD T117 Thread Miller.
HELLER Automatic Thread Millers (4).

MISCELLANEOUS.

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New ESSEX 18 Bandsaw.
New RICHMOND SR2 3ft. Radial Drill.
New ALBA 18in. Shaper.
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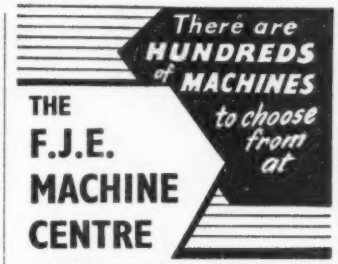
All Machines motorised 400/3/50 unless otherwise stated.



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Rex Hydraulic Hacksaw, 18in. blade, 8in. by 8in.

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Herbert Horizontal Milling Machine, 3ND, table 61in. by 15in., 4 spindle speeds.

3,000 K.G. Capacity Avery Hardness Testing Machines, 10in. dia. table (2).

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Craig & Donald Billet Shears, 8in. blade, 6in. by 1in. capacity.

Robertson Shears, ¼in. capacity, 10 h.p., 28in. blade, 9in. maximum opening. (2)

Robertson 7-roller Plate Flattener, 8ft. 6in. wide, approximately ¼in. capacity.

Berry 3-roller Plate Bender, 7ft. wide, approximately ¼in. capacity.

Sweeney Fly Presses, all sizes, 20 available.

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Oliver Planishing Hammer, 29in. gap.

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Surface Table, 6ft. by 3ft., on

four legs. In good condition. £45.—HARDEN PRECISION ENGINEERING, LTD., Manor Estate, Thundersley, Essex.

Craven 25ft. by 6ft. by 6ft. Planing

Machine with two toolboxes on cross-slide and one side toolbox on each upright. Motorised 400-440 volts, 3 phase, 50 cycles A.C. supply. NEW. Delivery June, 1958.—W. E. NORTON (MACHINE TOOLS), LTD., Grosvenor Gardens House, Grosvenor Gardens, London, S.W.1. 'Phone: Tate Gallery 0632/4. Cables: Norbros, London.

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Lathe (1955), with collet chuck, 7½ h.p. 400/3/50 motor and starter.—SOUTHERN ENGINEERING & MACHINERY CO., Connaught Buildings, Tanners Brook, Millbrook, Southampton. Tel.: Southampton 73101.

Herbert No. 0 Horizontal Mill.

A useful machine for End Milling and Keyways, 4 spindle speeds, 450-2,850 r.p.m., table 18 by 6, electric coolant, pole-change speeds, motor 440 volts, 3 phase, 50 cycles, modern machine, Unused. Cheap to clear.—BOX V687, MACHINERY, Clifton House, Euston Road, N.W.1.

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COLCHESTER 6in. Student and 8½in. Mascot Lathes.
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WOODHOUSE & MITCHELL 7in. Model, 70 Junior Lathe.
STANLEY 10½in. Lathe—38in. swing in gap.

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VICTORIA V2 Vertical, U2 and U3 Universal.
RICHMOND No. 4 Universal.

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RICHMOND SR2 36in. Radial.
PROGRESS 4E 1¼in. Pillar Drills.
MISC. ½in., ¾in. and 1in. Drills.

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BURDETT 18in. × 6in. Hydraulic Surface Grinder.
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UNION G25 Tool and Cutter Grinder.

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Capstan Lathes available in exchange
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MODERN

NEW MACHINES

MITCHELL 12½in. Lathe, 10ft. 9in. between centres, 4¼in. hollow spindle. Equipment.
MYFORD MG12 Cylindrical Grinder, 3 x 12 capacity. Full equipment.
MIDGLEY & SUTCLIFFE O3SD Universal Miller. Universal Dividing Heads.
COLCHESTER 'Mascot' 8½in. x 54in. Lathe. With equipment.
GRANOR Type HL 11in. Gap Bed Lathe. 5ft. between centres. Full equipment.
COLCHESTER 'Triumph' 7½in. x 48in. Lathe. Coolant, fourway toolpost, etc.
MITCHELL 8½in. Gap Bed Lathe, 4ft. 3in. between centres, fourway toolpost, chucks, etc.
VICTORIA U3 Universal Miller, 60in. x 12½in. table, rapid traverse.
MODERN 2C 1½in. capacity Capstan. Complete with bar feed.
SMART AND BROWN Model 'A' 4½in. S.S. & S.C. Precision Toolroom Lathe.
HARRISON 8in. x 48in. Lathe. Fourway toolpost, chucks, steadies, etc.
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HERBERT Small piece Lathe. Type 6WSL 12in. swing two tailstocks. **Price £110.**
ADCOCK & SHIPLEY 3ft. Radial Drill. Power feed to spindle. Coolant equipment. Good condition. **Price £315.**
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DELAPENA Model MA Bench Honer, 0·135 to ·625 capacity. **Price £50.**
MITCHELL 14½in. Lathe. 7ft. 9in. between centres. 4¼in. hollow spindle. Equipment. Overhauled. **Price £1,950.**

MODERN MACHINE TOOLS LTD

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GOSFORD STREET COVENTRY
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C·E·M

PEARSON Electro-Hydraulic Guillotine, 8ft. x ¼in., new, for early delivery.
PEARSON Electro-Hydraulic Guillotine, 8ft. x ¼in., new, for early delivery.
PEARSON Electro-Hydraulic Guillotine, 10ft. x ¼in., new, for early delivery.
ACME-GRIDLEY 4-spindle Automatic, 3⅛in. capacity, considerable equipment.
WICKMAN 5in. 5-spindle Automatic, modern machine, in excellent condition.
BENTLEY 200-ton Double Sided Power Press, 8in. stroke. New machine.
BENTLEY 80-ton Open Fronted Geared Power Press, adjustable stroke, 1in. to 5in. New machine.
BENTLEY 50-ton Open Fronted Inclinable Power Press, adjustable stroke, ½in. to 4in. New machine.
BENTLEY 30-ton Open Fronted Inclinable Power Press, adjustable stroke ½in. to 3in. New machine.

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All Machines motorised 400/3/50

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THOrnton Heath 1783

Progress No. 5E (New) Pillar Drilling Machine. Compound table, 2in. capacity, motorised 400/3/50.—SOUTHERN ENGINEERING & MACHINERY CO., Connaught Buildings, Tanners Brook, Millbrook, Southampton. Tel.: Southampton 73101.

Gisholt No. 5 Turret Lathe, chucking, 400/3/50.—A. McNAMARA & CO., New Line, Bacup, Lancs. 'Phone: Bacup 946.

Herbert Flashcap 1951. Insp. 31-2511 with air chuck and equipment, duo-rate saddle—coolant pump splash guards—chuck guards, etc. Maintained by makers. £650.—HARDEN PRECISION ENGINEERING, LTD., Manor Estate, Thundersley, Essex.

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TERMS ARRANGED.
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DRUMMOND Capstan, Type "K" A.G.H., power feeds to cross slide and capstan, speeds up to 1,000 r.p.m., 1¼in. capacity, for collets or chucking. Motorised 400/3/50. £175.

SOUTHWARK No. 2 Capstan for chucking and collets, Motorised 400/3/50, with set of collets, suds pump, etc. £175.

BALLINGER Model "C" Abrasive Cutting Off Machine, 16in. Abrasive Wheel. Motorised 400/3/50, will cut up to 2in. diameter solid bar. £150.

WE HOLD BIG STOCKS OF LATHES, SHAPERS, MILLS, DRILLS AND PRESSES. PLEASE WRITE FOR LISTS.

HARRY KIRK

can recommend the following modern quality machines from STOCK :

KEARNS No. 2 Horizontal Boring, Milling, Drilling and Facing Machine, 3in. sliding spindle, 20in. dia. facing head. Size of top table 48in. by 48in.
SWIFT 4ft. Radial Drilling Machine. Elevating arm, box table.
BROWN & SHARPE HORIZONTAL SPINDLE SURFACE GRINDING MACHINE. Capacity 18in. by 6in.
CHURCHILL INTERNAL GRINDING MACHINE. Capacity 24in. diameter by 9½in. long.
MODERN OPTICAL PROFILE GRINDING MACHINE.
LANG JUNIOR CENTRE LATHE. Capacity 6½in. centre height by 30in. between centres.
CHURCHILL REDMAN Heavy Duty Shaping Machine. 24in. stroke, swivelling vice. 10 h.p. Motor.
ASQUITH 4ft. 9in. PORTABLE UNIVERSAL RADIAL DRILLING MACHINE. No. 4 M.T. spindle, 6 speeds 41/300 r.p.m., motorised 400/3/50 cycles supply.
B.S.A. 9in. SINGLE SPINDLE CHUCKING AUTOMATIC. Complete with air-operated chuck.
KITCHEN & WADE VERTICAL FINE BORING MACHINE. 14in. stroke. Compound table.
KITCHEN & WADE HEAVY DUTY PILLAR DRILL. No. 5 Morse. Speeds 22-1,000 r.p.m.
CHURCHILL 12in. by 36in. UNIVERSAL Hydraulic Grinding Machine.

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BRANDON ROAD WORKS, BRANDON ROAD, COVENTRY.
'Phone: WALSGRAVE-ON-SOWE 2213/4.

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A selection from our 1,500 available tools

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SCHNEIDER 24in. by 8in. Horizontal spindle Surface Grinder hydraulic feeds grinding wheel head swivels through 90°, enabling slideway and cup wheel grinding to be done NEW.

KITCHEN & WADE V.15 Vertical Honing (Hydraulic) Machines, capacity 2in.-9in. dia., and up to 25in. length of bore, speeds and strokes hydraulically, variable speeds 0-250 r.p.m., strokes 0 to 80ft. per minute.

ARCHDALE 30in. Vertical Millers, table 44in. by 14½in. auto. longtl. feed 30 in., auto cross feed 12in., hand vertical adjustment 18in., 12 spindle speeds 29 to 520 r.p.m.

FAIRBAIRN, LAWSON COOMBE & BARBOUR S & S Lathe, swing 36in., takes 23ft. between centres, two saddles, both with taper turning and electric control 4¼in. hollow mandrel, 24 spindle speeds 1·08 to 152 r.p.m.

'COLONIAL' Broach Grinding machine, capacity 6in. by 72in.

SENTINEL 6in. by 30in. Hydraulic Copying Lathe, operated on electraulic system, 5 slides, 2 back, 3 overhead.

LIBBY 2H8 Universal Combination Turret Lathe, height of centres 13¼in., swings over cut-off slide 25in., hole through spindle 8¼in., 8 spindle speeds 8-128 r.p.m., chases 4 to 64 t.p.i. Quick return to cut-off slide, saddle and turret.

VOLMAN 8in. by 24in. capacity high-speed Sliding and Surfacing Diamond Turning Lathe, 12 spindle speeds 95-1,180 r.p.m.

MAAG SS.30 Automatic Gear Grinding machines for spur gears, max. dia. for up to 2⅜in. face 11¾in., from 2⅜in. to 5½in., 8⅜in., min. pitch circle dia. 1⅜in., max./min. cutting pitch 2½ to 12½ d.p., max./min. number of teeth 120/10.

PITTLER RE.11.60 Turret Lathes, ⅝in. centres spindle flange to turret 31½in., spindle hole 2⅜in., swing 21⅜in., fitted chasing attachment.

HERBERT 23V Vertical Miller, table 68in. by 12in., auto longtl. feed 48in., auto cross feed 18in., vertical travel 25in., vertical adjustment of head 10in., spindle speeds 16·5 to 427 r.p.m.

ROWLAND Model ADD motor-driven Hydraulic Duplex Surface Grinding machine, disc. opening 13½in.

CHURCHILL VXA Hydraulic Vertical spindle Surface Grinder, table 60in. by 16½in., dial of segmental wheel 18in., max. wheel to table 15in., table traverse hydraulically variable up to 100ft. per minute.

RYDERMATIC No. 12 single-spindle Vertical multi-tool Chucking Auto., max. swing 20in., length between centres 16in., turning slide vertical stroke 8in., facing slide stroke 5½in., auxiliary stroke 4in., speed range 31½in. to 309.

BERTRAM (NILES TYPE) S.S. & Sc Lathe, 17½in. centre on 39ft. bed, 30ft. between centres, 3in. hollow mandrel, 2 saddles, both with independent electric control and taper turning.

PEARN-RICHARDS No. 1 Horizontal Boring and Facing machine with facing head, quartering table Vernier Scale, table 20½in. by 32in., facing head 18in. dia.

CHURCHILL PBH Universal Grinding machine, capacity 16in. by 50in., work speeds 46-181 r.p.m., table traverse (Hydraulic) up to 180in. per minute.

VAN NORMAN L.V. Vertical Milling Machine Table, 32½in. by 9in., auto, longtl. feed 17in., hand cross 6⅜in., hand vertical 16½in., 8 speeds from 100 to 2,500 r.p.m.

ALL MOTORS 400-440 volts, 3-phase, 50-cycle SUPPLY

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Complete Installation for Producing artificial three-phase current from single-phase supply, comprising motors and all necessary switchgear.—ENGINEERING PRODUCTS, LTD., Littlers Close, Merton Abbey, London, S.W.19. LIBerty 1085/6.

Sondermann 35in. Duplex Vertical Borer, double motor drive, e.g., 15 speeds, power feeds all direction. £860.—WESTCLIFF ENGINEERING, Rye Road, Hoddesdon. 'Phone 2340.

Gisholt No. 3 Ram Type Turret Lathe with hardened and ground bed ways, offered at bargain price.—WEST MIDLAND EQUIPMENT CO., 10, Hagley Road, Stourbridge, Worcs. Stourbridge 4187.

D. S. & G. Lathe, S.S. & S.C. Type 4AN. Cap. 7in. by 42in. A.G.H. Gap bed. Motorised.—WILCOX & CO., Barr Street, Birmingham, 19. NORthern 1234/5.

C.V.A. Vertical Miller, 25in. by 9in. table, very good condition, £275.—A. McNAMARA & CO., New Line, Bacup, Lancs. 'Phone: Bacup 946.

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Wanderer Universal Milling Machine. Table 30in. by 10in. Speeds 96-1,500 r.p.m., complete with dividing head, toolholders, etc. As new.—BOX T105, MACHINERY, Clifton House, Euston Road, N.W.1.

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3¼in. **CONOMATIC** 4-spindle Bar machine, 1943 manufacture, in excellent condition.
6½in. RAC.6. 6-spindle **ACME GRIDLEY** Chucking Machine, 1943 manufacture, in excellent condition, £1,500, equipment extra. Many attachments available at reasonable prices.
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SCHUTTE SB.22 6-spindle Bar machine, ⅞in. capacity.
SCHUTTE VB.35 4-spindle Bar machine, 1¼in. capacity approx.

BOX V719, MACHINERY, Clifton House, Euston Road, N.W.1.

Butler 8in. Slotting Machine, motorised 400/3/50.—SOUTHERN ENGINEERING & MACHINERY CO., Connaught Buildings, Tanners Brook, Millbrook, Southampton. Tel.: Southampton 73101.

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NEW PEDESTAL TYPE CRAMP FOLDING MACHINES.

1—48in. by 16 g. **MORGAN.**
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"Drummond" Maximatic Auto- matic Multitool Lathe, capacity 9in., by 42in. Max. swing over bed 18in.; over slides, 12in. Fully automatic. S.C. motor drive, 400-440/3/50. Air-operated tailstock. Quick-action chuck. Post-war machine.—LEE & HUNT, LTD., Crocus Street, Nottingham.

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URQUHART

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MITCHELL 7¼in. by 42in. by 25in. gap, A.G.H., motorised.
COVMAC Lathe, 8¼in. by 60in. between, A.G.H., gap bed, spindle speeds 18-450 r.p.m., mot. 415/3/50.
CHURCHILL CUB Lathe, 6in. by 24in., A.G.H. mot. 415/3/50.

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WICKMAN Autos, Vinco model, cap. 4mm. motorised. £95.
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WARD 1A Capstans, 1in. collet cap. H.S. range up to 4,130 r.p.m. Ball chuck, bar feed, mot. coolant pump, 400-440/3/50 A.C.
HERBERT 2D Capstans, 16 speeds, 50/2,550 r.p.m. Draw-in collet, bar feed, power feed turret, "duo-rate" cross slide, "Flamard" bed, mot. coolant pump 415/3/50.
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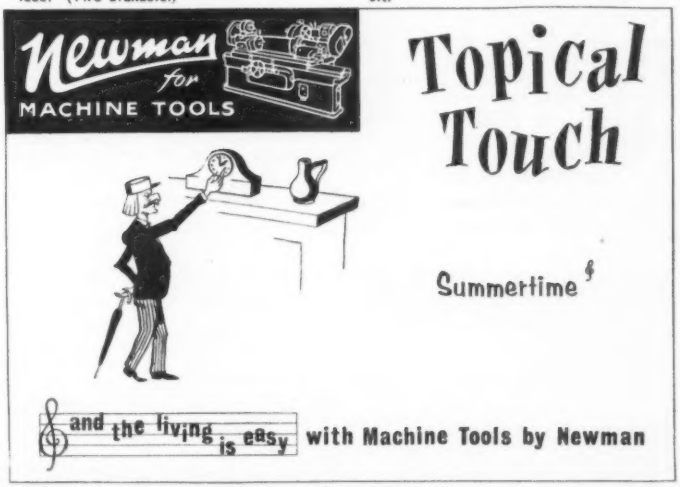

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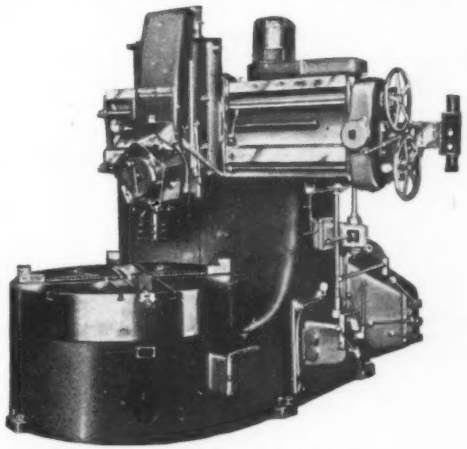

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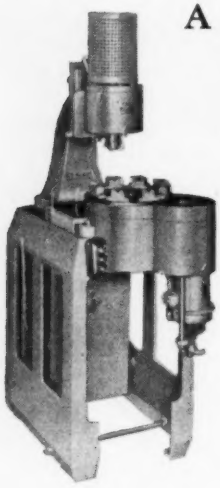

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CINCINNATI Type M Vertical, 47in. by 10½in., power and rapid traverse, all ways, new condition. **£675.**
HERBERT No. 33 Plain, all geared, motorised. **£85.**
HOLROYD twin spindle Profile Miller, 18in. by 15in., absolutely as new. **£175.**

CAPSTANS

DRUMMOND Model K Capstan, 2in. H.S., 1,000 r.p.m., covered bed, well equipped and as new condition. **£495**
SOUTHWARK No. 2, 1¼in. cap. Capstan. **£95.**
WARNER & SWASEY 1in. cap. Capstan, Collets, etc. **£75.**
GISHOLT No. 4, 2in. cap. Capstan, very clean condition. **£225.**

GRINDERS

NEWALL 36in. by 10in. hydraulic plain Cylindrical Grinder, new condition. **£425.**
MATRIX Universal Grinder, 10in. by 20in., very clean. **£375.**
ORCUTT 20in. hydraulic Spline Grinder **£150.**
HUNT 18in. by 6in. Surface Grinder, with magnetic chuck and dust extractor. **£275.**

8, Clarendon Ave., Leamington Spa. Telephone 1215

600

NEW RASKIN PRESSES

R.7A High Precision Rigid Open Front Geared Press. Capacity 150 tons. Table size 42½in. by 27½in. Adjustable stroke.

R.6A High Precision Rigid Open Front Geared Press. Capacity 100 tons. Adjustable stroke. Table size 29½in. by 24in.

No. 100IH Heavy Duty High Precision Geared Open Back Inclinable Press. Capacity 100 tons. Adjustable stroke. Air cushion. Table size 39½in. by 27½in.

No. 35IB High Precision Open Back Inclinable Press. Capacity 35 tons. Adjustable stroke. Table size 28in. by 19in.

No. 4B High Precision Rigid Horn Press with adjustable and swivelling table. Capacity 50 tons. Adjustable stroke. Table size 27½in. by 21in.

GEORGE COHEN SONS & CO. LTD.,
WOOD LANE, LONDON, W.12
Tel.: Shepherds Bush 2070, and
STANNINGLEY, NR. LEEDS.
Tel.: Pudsey 2241.

Senior (New) M1 Horizontal Milling Machine. Table 25in. by 6½in., motorised 400/3/50.—SOUTHERN ENGINEERING & MACHINERY CO., Connaught Buildings, Tanners Brook, Millbrook, Southampton. Tel.: Southampton 73101.

G. M. BUCKINGHAM LTD.

New Machines for delivery ex-stock

LATHES

COLCHESTER 5in. Chipmaster, 6in. Student, 6½in. Master, 7½in. Triumph and 8½in. Mascot.
WILLSON 6½in. Mark I, 7½in. Newel and Mark V, and 8½in. Pitel.
CARDIFF 7½in. to 11in., various bed lengths.

MILLING MACHINES

VICTORIA Omnimils, Models 01 and 02, both with Hilger and Watts Optics.
Also all other Victoria Universal and Vertical Models.
DENBIGH Model C4 semi-Universal, 46in. × 10in.
RICHMOND H.S. Turret Mill.

SHAPING MACHINES

NEW **INVICTA** "Maior" Shapers, 30in. and 24in., with swivel table and auto downfeed.
Also other standard **INVICTA** and **ALBA** Models, 10in. to 24in.

DRILLING MACHINES

RICHMOND 4ft. 6in. Radial Drill, Model HB3/12, 2in. cap. with coolant equipment.
RICHMOND 36in. Radial Drill, Model SR2, 1½in. cap. with power elevation and coolant equipment.
PROGRESS 5E 2in. cap. Pedestal Drill.
PROGRESS 4E 1½in. cap. Pedestal Drill.

GRINDING MACHINES

MYFORD MG12 Cylindrical Grinder, cap. 5in. by 12in.
EXCEL Model 3/12 Hydraulic Surface Grinder, 24in. by 8in.

8, Clarendon Ave., Leamington Spa.
Telephone 1215

1 only, **CINCINNATI** Grinder No. 2. Capacity 0.062 to 6in. dia. Serial No. 2M2HLJ355.
1 only, **ARCHDALE** Horizontal Miller, 18in Table size 10 by 38.
1 only, **PALLAS** Horizontal Miller with Sadi Drive. Table diameter 7½ by 37.
1 only, 2 Spindle Pillar Drill, **AJAX**: Capacity 0.0-¾in. Table size 15 by 37.
1 only, **HULLER** Tapping Machine. Maximum capacity approximately 1in. Serial No. S 33903-6T.1.
1 only, 6in. **LE-BLONDE** Centre Lathe. 30in. between centres—this machine has no screw-cutting attachment, complete with back plate and chuck.

TELEHOIST LIMITED,
MANOR ROAD, CHELTENHAM.
'Phone: Cheltenham 53254.

Multi-Spindle Drilling and Tapping machine, Boley 10 spindle adjustable. ¼in. cap. Motorised, variable speed, perfect cond.—C. L. THOMAS, LTD., 18, Park Avenue, Solihull 1281.

Two Colchester Mascot (New) S.S. & S.C. Gap Bed Centre Lathes, 8½in. height by 4ft. 6in. between centres.—SOUTHERN ENGINEERING & MACHINERY CO., Connaught Buildings, Tanners Brook, Millbrook, Southampton. Tel.: Southampton 73101.

TENDERS

BY ORDER OF THE MINISTER OF SUPPLY

SALE BY TENDER.

MACHINE TOOLS

The Minister of Supply Offers for sale by tender Machine Tools by leading British and Continental makers including the following:—

Adcock & Shipley, Corona, Holroyd, Jones & Shipman, Leland Gifford and Pollard Drilling Machines.

Girard and G.S.P. Radial Drilling Machines.

Nova "A" Auto. Internal Grinders; Churchill and Snow Surface Grinders; Lumsden Wet Tool Grinder.

Edgwick and Fromag Keyseaters.

Herbert France and Flat Capstan Lathes; B.S.A. Multi Tool Lathes; Gisholt Turret Lathe.

Adcock & Shipley, Sant Andrea, Werner, Edgwick and Sunstrand Horizontal Milling Machines.

Archdale, Biernatski, Brown & Sharpe, Herbert and Van Norman Vertical Milling Machines.

Pegard and Olivetti Production Milling Machines.

Hey Duplex Spline Milling Machines.

C.S.P. and Butler Slotting Machines.

Heller and Clifton & Baird Cold Saws.

Brinell Hardness Testing Machines.

Honing, Rifling, Screwing, Tapping and Reaming Machines, Thread Millers, Bench Grinders, Spot Welder, etc.

All the machine tools are lying at Dowlais, Glamorganshire.

Application for tender forms should be made as soon as possible to the Ministry of Supply Disposals 2 (*b*), Room 621, First Avenue House, High Holborn, London, W.C.1.

Tender Forms will contain descriptions of the machine tools, location in full, and the Conditions of Sale under which they are offered.

Offers are invited for single machines.

The final date for the receipt of tenders will be 6th May, 1958.

The Director-General, India Store Department, Government Building, Bromyard Avenue, Acton, London, W.3, invites tenders for the supply of:—

(*a*) "WHIRLBLASTER TROUGH CONVEYOR BELT DRUM—1 off—Centrifugal Capacity 150 Kgs./min. of abrasive; effective volume 0.75 cu. metres; motor driven."

(*b*) "ROTARY TABLE SHOT PEENING MACHINE—1 off—airless Projection; total weight 1,500 kgs.; Motor driven."

The Tender forms with schedules and specifications which are returnable on Thursday, the 8th May, 1958, may be obtained from the above office (C.D.N. Branch) on payment of a fee (which is not refundable) of ten shillings for each tender. The applications for Tenders should clearly state the reference numbers of the tenders required, 18044/1957.

The Director-General, India Store Department, Government Building, Bromyard Avenue, Acton, London, W.3, invites tenders for the supply of:—

(*a*) "UNIVERSAL GRINDING MACHINE—1 off—Swing over table 250 mm. max. length bet. Centres: 680 mm."

(*b*) "CYLINDRICAL GRINDING MACHINE—2 off—Grinding dia. 6in.-8in.; length bet. Centres: 36in."

The Tender forms with schedules and specifications, which are returnable on Thursday, the 8th May, 1958, may be obtained from the above office (C.D.N. Branch) on payment of a fee (which is not refundable) of ten shillings for each tender. The applications for Tenders should clearly state the reference numbers of the tenders required. 20008/1958.

The Director-General, India Store Department, Government Building, Bromyard Avenue, Acton, London, W.3, invites tenders for the supply of:—

"TURRET LATHES—BOTH HEXAGON AND DRUM TYPES 70 MM. and 65 MM-7 OFF."

The Tender forms with schedules and specifications, which are returnable on Thursday, the 8th May, 1958, may be obtained from the above office (C.D.N. Branch) on payment of a fee (which is not refundable) of ten shillings for each tender. The applications for Tenders should clearly state the reference numbers of the tenders required. 18048/GMK/HAL.

RECEIVED TOO LATE FOR CLASSIFICATION

Taylor & Challen No. 5 and 6 G.D.P. Double Action Presses urgently wanted.—Price, condition and location to BOX V758, MACHINERY, Clifton House, Euston Road, N.W.1.

Wanted, Centre Lathe In Good condition. Approx. 7½in. centres.—BOX V763, MACHINERY, Clifton House, Euston Road, N.W.1.

Two G. Autos Wanted by Surrey firm. State Serial Nos., equipment and price to BOX V 765, MACHINERY, Clifton House, Euston Road, N.W.1.

WANTED

In first class condition All Geared S.S. & S.C. Gap Bed Lathe, 12½in. Centres, Hollow Spindle, 3in. to 4in. Bore. Swing 25in. over saddle. 12ft. 6in. to 14ft. between centres. R.P.M. 10 to 300. Front Leadscrew and Feedshaft. Four post Toolholder on swivelling compound sliding saddle. Tailstock suitable for taper turning. Complete with 3-jaw and 4-jaw chucks. Travelling and fixed steadies.

Box V757, MACHINERY, Clifton House, Euston Road, N.W.1.

Classified Advertisements (*PLANT FOR SALE, contd.*)

AUCTIONS

E. R.

By order of the MINISTER OF SUPPLY

SALE BY AUCTION AT

MELTON MOWBRAY
(15 miles Leicester; 18 Nottingham; 16 Grantham).

MACHINE TOOLS. SURPLUS STORES AND SPARES. PAINT. LIFTING TACKLE.

now lying at

TECHNICAL STORES DEPOT, OLD DALBY

MINISTRY OF SUPPLY STORAGE DEPOT, GLADSTONE ROAD, NORTHAMPTON.

GENERAL STORES SUB-DEPOT, HOUGHTON-NEAR OLLERTON, NOTTS.

TECHNICAL STORES SUB-DEPOT, QUENIBOROUGH.

Centre, Precision and Boring Lathes; Toolroom and Surface Grinders; Millers; Slotting M/c; Blanking and Piercing, Moulding, Baling and Frame Presses; Pillar and Bench Drills; Thread-millers; Sand Dryer; Arc Welders; Woodworking Machines; Engine Belting; Compressor; Warehouse Platform Trucks; Steel Triangle Gyns; Sisal and Wire Ropes and Clamps; Cotton Sheeting and Blanketing; 43,000 gals. Paint; 400 tons Dry Paint; 25 tons Matrix Metal; Winches; Lifting Jacks; 18in. Lathe Chucks; Lathe Spares; Sewing M/cs; Oven Tubes; Transporter and other Vehicles; Tow Motor; Lubricating Plant; Radio Spares and Instruments; Cine Equipment; 10-cwt. Warehouse Cranes. Stores: Tubing and Bar Iron; Carbon Steel; Polishing, Grinding and Wire Wheels; Celluloid Sheets; Petrol Hose, and Miscellaneous Stores.

Which will be SOLD BY AUCTION by

SHOULER & SON

ON WEDNESDAY AND THURSDAY, 7th and 8th MAY, 1958.

At their Auction Assembly Rooms, 1 Norman Street, Melton Mowbray, at 10.30 a.m. prompt each day.

ON VIEW: 1st, 2nd, 5th and 6th May, and on mornings of Sale.

CATALOGUES: 1s. each (P.O. only, no stamps), obtainable from Auctioneers (Dept. 12), 1 and 3, Norman Street, Melton Mowbray. Tel. 81 and 669.

By Order of the E. R. Minister of Supply

27th Sale.

CENTRAL ORDNANCE DEPOT, BICESTER, OXON.

IMPORTANT SALE BY AUCTION

by

MIDLAND MARTS LIMITED

of

GOVERNMENT SURPLUS MACHINE TOOLS, TOOL KITS, TOOLS, GENERAL STORES, VEHICLE SPARES AND TYRES, and 988 VEHICLES AND TRAILERS,

including:

Tecalemit Lubricating Plants, Power Rammers, Drilling Machines, Generators, Electrical Furnaces, Winches, Reboring Machines, Tool and Cutter Grinding Machines, Fuel Pumps, Test Benches, Gas Cylinder Trolleys, Cranes, Stackers, Electric Hacksaws, Le Blonde and other Lathes, Wadkin Saw Bench, etc.

Tool Kits for Fitters, Vehicle Mechanics, Carpenters, Electricians, Metal Workers, Blacksmiths, Painters, etc.,

which will be sold in large and small lots to suit all buyers, on

TUESDAY, WEDNESDAY and THURSDAY, APRIL 29th, 30th, and MAY 1st, 1958.
at 11 a.m. on each day.

View Days: Thursday, Friday and Monday, 24th, 25th and 28th April.

Catalogues, price 6d., to admit two to view and one on sale days, from the Auctioneers, Dept. 11, Market Square, Bicester, Oxon (Tel: 73).

By instructions from the Joint Liquidators:—ANDREW BRODIE, ESQ. (Messrs. J. PATERSON BRODIE & SON) and P. J. SNOW, ESQ. (Messrs. BOURNER, BULLOCK & CO.).

Re: **THOMAS HUGHES & SON, LTD., EARTHENWARE,**

and

THOMAS HUGHES SANITARY CO., LIMITED.
(In Voluntary Liquidation.)

SALE OF GENERAL EARTHENWARE AND SANITARY WARE MANUFACTURERS PLANT AND MACHINERY, MOTIVE POWER PLANT, OFFICE FURNITURE, MOTOR VEHICLES, STOCK-IN-TRADE AND GENERAL EFFECTS.

UNICORN WORKS, LONGPORT, STOKE-ON-TRENT:

CHARLES BUTTERS & SONS

will sell by Public Auction on the above premises on **WEDNESDAY, 23rd APRIL, 1958,** the remaining Plant and Machinery including:

KILNS. Two modern intermittent electric kilns (MEB) (1 Twin truck two chamber, and 1 single truck twin chambers, each with electrofio control and switchgear). Electric biscuit kiln (partly erected).

PREPARATION AND MAKING PLANT. 2 Blake Marsden Stone Breakers, 4ft. 6in. Grinding Pan, Range of 4 overdriven blungers, 2 underdriven ditto, Single ditto 4½in. by 4in. by 3in. d/w and l/w Pattern press and slip pumps, Triple and single deck vibrator sifters, Electro-magnetic separators, 6ft. Pug mill, 2 Gosling and Gatensbury Casting Plants (each with blunger, ark and slip pump), 9 various motorised Jiggers, Jolleys, each with individual motorised spreaders, motorised dish making machine, 2 Wad Mills, 5 Towing Spindles, Drymat dust collectors, Drying cabinets, biscuit Brushing Machines, Polishing Machines, Printers Rotary Printer, Viscosity Testing Set, Craze Testing Pot, etc.

VEHICLES, HANDLING AND WEIGHING EQUIPMENT. Bedford a.w.b. Lorry with tipper body, Scammell ditto, Brush Electric Pony and Battery Charger, 3 Mangle type hoists, and gearing, Dippers mangles, 2 Swivelling jib cranes, Pooley 20 cwt. Dormant Platform weighing machine, 2 smaller portable ditto, 4 and 2 wheel warehouse trucks, etc.

MAINTENANCE EQUIPMENT includes Smith Hearth, Pillar Drill, 2 D/E Grinders, 3 various chain blocks, Screwing and Cutting Tackle for Pipes, Conduit, Taps, Diew, Drills and small hand tools, Vices, Set of Skatoskalo Tools, Hammers, Insulating Bricks, Fuse Boxes, 3 phase and single phase motors, switchgear, etc.

OFFICE AND CANTEEN FURNITURE AND EQUIPMENT includes 3 safes, 9 oak desks, Tables, 4 Typewriters, Filing Cabinets, Swivel Chairs and others, Santon Electric Water Boiler, Steel gas heated cabinet, Ascot Water Heater, Gas Stove, Tables, Stack-a-back chairs, etc.

GENERATORS MOTIVE PLANT, ETC. Sentinel 2 crank d/a h/s Vertical Steam Generator Set (220 v.), Crompton, 220 v. Dynamo, 3 small Steam Engines, Shafting, Belting, etc.

MISCELLANEOUS EFFECTS INCLUDE Steam heating units, Racking, Benches, Utensils, Liners Wheels, Sponges, Flannel, Tissue, Litho Sheets, Overalls, Jackets, Oil and Grease, Placers Steps, Shovels, Hose, Glue, Time Clock, Electric Clock, 60 Potters Stools, Disinfectant, Brushes, etc., etc.

Sale to commence at 10.30 a.m. Prompt. On view Monday and Tuesday prior to sale from 9.30 a.m. until 4.30 p.m. Catalogues, price 6d. each, available from the Auctioneers Offices, Trinity Buildings, Trinity Street, Hanley. Tel. S-O-T. 21328/9 or Tel. Leek 556.

By Order of the Liquidator, P. O. Davis, Esq., F.A.C.C.A., and the Owners.

Re: **Motor Traction Ltd. (In Members' Vol. Liq.).**

RUTLAND WORKS, VULCAN WAY, NEW ADDINGTON, NEAR CROYDON, SURREY.

HENRY BUTCHER & CO.

are instructed to offer for SALE BY AUCTION at THE WORKS, on
TUESDAY, 6th MAY, 1958,
at ELEVEN a.m.
AS A FIRST LOT (Unless previously sold by Private Treaty)
THE RECENTLY ERECTED

SINGLE-STOREY FACTORY

with Two Floor Office Block,
FLOOR SPACE OF 20,000 SQUARE FEET,
GROUND AREA OF ABOUT 1 ACRE.
Good Loading Facilities. All Services.
Extensive Concrete Paved Yards.
Held on Lease for 96 years from 25th March, 1954, at a
Ground Rent of £350 per annum.
VACANT POSSESSION ON COMPLETION.
TO BE FOLLOWED BY THE SALE IN LOTS, OF THE

MACHINE TOOLS, STORES & EQUIPMENT

including
S.S. AND S.C. LATHES
by "Aster" and "Dean Smith & Grace."
RADIAL, PILLAR AND BENCH DRILLS
by "Archdale," "Craftsman" and "Denbigh"
"BLACK & DECKER" VALVE REFACERS,
HORIZONTAL BORER,
BENCH AND SURFACE GRINDERS,
ARC WELDERS AND PROFILE CUTTERS,
MILLING MACHINES, POWER HACKSAWS
HYDRAULIC PRESSES.
"NIAGARA" POWER WASHERS.
ENGINEERS' SMALL TOOLS AND GARAGE EQUIPMENT.
BENDING, FOLDING AND SWAGING MACHINES.
MOBILE AND STATIONARY COMPRESSORS.
"RUTLAND" 1 TON TRUCK.
"COMMER" MOBILE WORKSHOP.
Workshop Stores. Smiths' Tools. Stock of Paints.
MOBILE AND STATIC WELDING UNITS.
OFFICE FURNITURE AND DRAWING OFFICE EQUIPMENT.

Combined Particulars and Conditions of Sale of the Property and Catalogues of the Plant, Machinery and Equipment (when ready), price 6d. each, may be obtained of:

Messrs. DAVIS, BURTON & CO., Certified Accountants, 120, George Street, Croydon, Surrey. (Telephone: CROydon 2291); of

Messrs. DURRANT, COOPER & HAMBLING, Solicitors, 70/71, Gracechurch Street, London, E.C.3; and of

Messrs. HENRY BUTCHER & CO., Auctioneers, Valuers and Surveyors of Factories, Plant and Equipment, 73 Chancery Lane, London, W.C.2.

Telephone: HOLborn 8411 (eight lines)

ASFORDBY, Melton Mowbray

Auction Sale of whole of

ROAD CONTRACTORS PLANT; MACHINE TOOLS;

Excavators and Spares; Barber Greenes; Caterpillar D 8's; Vans; Lorries and Low Loader; Scrapers; Scammel Tractor Unit, etc.

THURSDAY, 1st MAY, 1958.

Catalogues, 6d. each, from SHOULER & SON, Auctioneers, Melton Mowbray. Tel.: 81.

SITUATIONS VACANT

If you do not wish your reply to any Box No. advertisement in this section to be forwarded to certain firms, please advise us. Your reply will then be destroyed, but you will not be notified as this would disclose the identity of the advertiser.

Planning Engineer Required by a West Midland Engineering Company employing 650, to be responsible for Tool Design, Operational Planning and Estimating.

Candidates must be Apprentice Trained with a good technical education and have experience in operational layouts, design of press tools, gravity dies and machine shop jigs and fixtures.

Apply giving age, details of experience, qualifications and present salary.

BOX V749, MACHINERY, Clifton House, Euston Road, N.W.1.

A Light Engineering Company, equipped with the most modern machine tools and engaged upon prototype and development machining, urgently requires a Machine Shop Foreman. Applicants, who should be between 30 and 35 years of age, must previously have held a similar position and be fully conversant with modern production methods. Minimum qualifications: O.N.C. Attractive salary; Pension and Profit-sharing Schemes; excellent working conditions and assistance with housing if required.—Write giving fullest details, to UNIVERSAL PATTERN CO., LTD., Kelvin Way, Crawley, Sussex.

Works Manager Required for small estab. engineering Company in East Surrey. New Factory and equipment, general light and precision engineering—costing and estimating and supervision experience essential; able to take full control when occasion arises, good prospects to right man.—State age, experience, salary required, etc., etc., to BOX V759, MACHINERY, Clifton House, Euston Road, N.W.1.

Highly Paid Secure and Interesting posts are always available for technically trained men. Find out how you can put some letters after your name by preparing at home in "No Pass—No Fee" terms for A.M.I.Mech.E., A.M.I.Prod.E., A.M.S.E., City and Guilds, etc., etc. Full details of exams and hundreds of courses in all branches of Engineering, Draughtsmanship and Management, the Benefits of our Employment Dept., and unique record of 95 per cent. successes, are given in "Engineering Opportunities"—valuable 144-page Guide which will reveal many chances you are now missing. Write for your copy today (stating subject of interest). —FREE and without obligation.—B.I.E.T., Dept. 34a, Wright's Lane, London, W.8.

SALES CAREER AS TECHNICAL SALES

assistant offered to young man by London manufacturers of precision machine shop equipment. Interesting job with excellent prospects for suitable candidate with good production background and sales ambitions.

Full details to

BOX V764, MACHINERY,
Clifton House, Euston Road, N.W.1.

Ashmore, Benson, Pease & Co., Stockton-on-Tees, require work study engineers to join their production engineering staff. Applicants should be conversant with work study techniques and have experience in applying them to general engineering work in heavy and medium machine shops.—Please reply stating experience and salary required, to:—STAFF PERSONNEL MANAGER.

Work Study—An Opportunity occurs to join the Work Study Department of a progressive West London factory. Applicants should have served a trade apprenticeship or equivalent, and had about three years' experience in all aspects of work study.—Apply in writing giving details of age, qualifications, experience and present salary to BOX TP.4574, A.K. ADVG., 212a, Shaftesbury Avenue, London, W.C.2.

THE ROCKWELL MACHINE TOOL COMPANY LIMITED

require a

SALES ENGINEER

To deal with all matters relating to the promotion of sales of the British built "U.S." Multi-Slide Machines. Essential qualifications are considerable experience of multi-slide or progression tooling and commercial experience.

Please apply by letter, giving full particulars, to

WELSH HARP
EDGWARE ROAD
LONDON, N.W.2

London Machine Tool Merchants require young man about 20 with some basic engineering knowledge and/or workshop experience, to assist generally with office routine and indoor sales work. An excellent opportunity for someone with intelligence and initiative to learn and make his way in the machine tool trade.—Write giving fullest particulars to BOX V724, MACHINERY, Clifton House, Euston Road, N.W.1.

Jig and Tool Designers are required by CROMPTON PARKINSON CHELMSFORD) LIMITED. Interesting and varied work is offered to men of experience and sound practical knowledge. Good working conditions, five-day week. Sports and Social Club, canteen facilities, Superannuation Fund.—Apply giving full details of experience, training and age, to PERSONNEL OFFICER, CROMPTON PARKINSON (CHELMSFORD), LIMITED, Chelmsford, Essex.

CHIEF PRODUCTION ENGINEER
REQUIRED BY
W. H. ALLEN SONS & CO. LTD.,
Atlas Works, Pershore, Worcs.

Manufacturers of light and medium size precision gear boxes. Post carries responsibility for work study, jig and tool design, plant layout and process planning.

Applicants must be established Work Study Engineers with a sound practical background and technical training to H.N.C. in production engineering or equivalent. Good superannuation scheme and conditions. Successful applicant would be assisted in the removal of household effects to district concerned in which housing accommodation will be available.

Apply (in confidence) stating experience, positions held and salary range, to the Personnel Manager at the above address

NOTTINGHAM AND DISTRICT TECHNICAL COLLEGE,

SHAKESPEARE STREET, NOTTINGHAM.

Principal: D. A. R. CLARK, M.Sc. (Tech.), M.I.Mech.E.

Applications are Invited from Engineering Graduates for appointment to the post of RESEARCH ASSOCIATE IN MECHANICAL ENGINEERING. Previous research experience is desirable but not essential. The post offers considerable scope and encouragement will be given to obtain higher qualifications.

Salary: £650 by £50 to £750 per annum.

Further particulars and form of application may be obtained from the Principal, to whom completed forms should be returned not later than 22nd May, 1958.

Senior D.O. Checker Required. Interesting work with progressive company. Applicants should have at least O.N.C. or equivalent together with both shop and D.O. experience of production methods in the field of electro-mechanical engineering. Age 30-40. —Apply in writing: THE WEST LONDON DRAWING OFFICE, 27, George Street, Richmond, Surrey.

DESIGNER DRAUGHTSMEN

A large group of engineering companies with its headquarters in the Midlands has initiated a new Plant Development Division whose duties will cover the creation and development of automatic machine tools, processing plant, mechanical handling equipment, hydraulic equipment, etc. A design office is being created for this purpose and both senior and junior design draughtsmen are invited to apply for the positions available. Seniors' salaries will range from £800 per annum at 25 upwards and will be assessed against experience. O.N.C. or H.N.C. standard preferred but is secondary to experience in this type of work if satisfactory evidence is forthcoming. Apply in writing to Manager, Plant Development Division, Box V.709, MACHINERY, Clifton House, Euston Road, N.W.1.

Classified Advertisements (*SITUATIONS VACANT, contd.*)

TECHNICAL SALES CORRESPONDENT

Experienced in Machine Tool Sales Organisation, is offered A RESPONSIBLE POSITION by Swiss Machine Tool importers situated in London. Good salary and prospects for a qualified and energetic person. Write in confidence with full details of past experience to the Managing Director,

Box V756 MACHINERY
Clifton House, Euston Rd., N.W.1

A METALLURGIST and an **ENGINEER** are required by well known makers of cemented carbides to join a research team working, in new laboratories, on wear and the development of new tool materials. The great variety of machining problems ensures that the investigations being carried out on original lines are of continuing interest. Applicants should have good scientific and technical training, a University degree or equivalent being desirable.
Write, giving age, qualifications, experience and salary to
Box V699, MACHINERY,
Clifton House, Euston Road, N.W.1

Process and Methods Engineers, experienced in light and medium engineering required urgently. Commencing salary around £750 p.a. with participation in Profit Sharing Bonus Scheme and pension fund.—Please apply giving full details of past experience to: PERSONNEL MANAGER, BROOM & WADE, LTD., High Wycombe.

REPRESENTATIVES

Representatives Interested in introducing Re-conditioning of Machine Tools.—Please apply: BOX V679, MACHINERY, Clifton House, Euston Road, N.W.1.

TECHNICAL REPRESENTATIVE

Required for North West Birmingham and Black Country, for the sale of special-purpose machine tools and specialised machine tool attachments and accessories.

Applicants must advise technical qualifications and only those with workshop experience should apply.

Remuneration by fixed salary plus expenses. Car will be provided.

London interviews arranged with expenses paid. Write in strictest confidence to

Box V762 MACHINERY
Clifton House, Euston Rd., N.W.1

Well Established London Firm trade Toolmakers require representation in Midlands and West Country, including Wales. Commission basis. Reputable Agents with good connections.—Send full particulars to BOX V767, MACHINERY, Clifton House, Euston Road, N.W.1.

Wanted, a Number of Free- Lance Representatives already calling on the Engineering Industry to sell precision Dial Gauges, Lathe Tools, Tungsten Carbide, H.S.S. and tool steel bars, etc.—Write BOX V766, MACHINERY, Clifton House, Euston Road, N.W.1.

Technical

Sales Representative

required

operating from Manchester Area—to cover Lancashire, Cheshire and Districts—by very well established Machine Tool Importers and Merchants—good prospects for energetic man—write with details and experience, etc., to:

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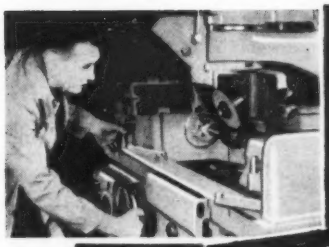

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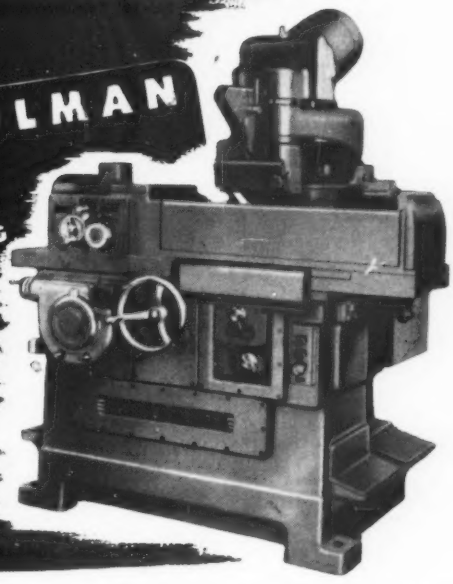

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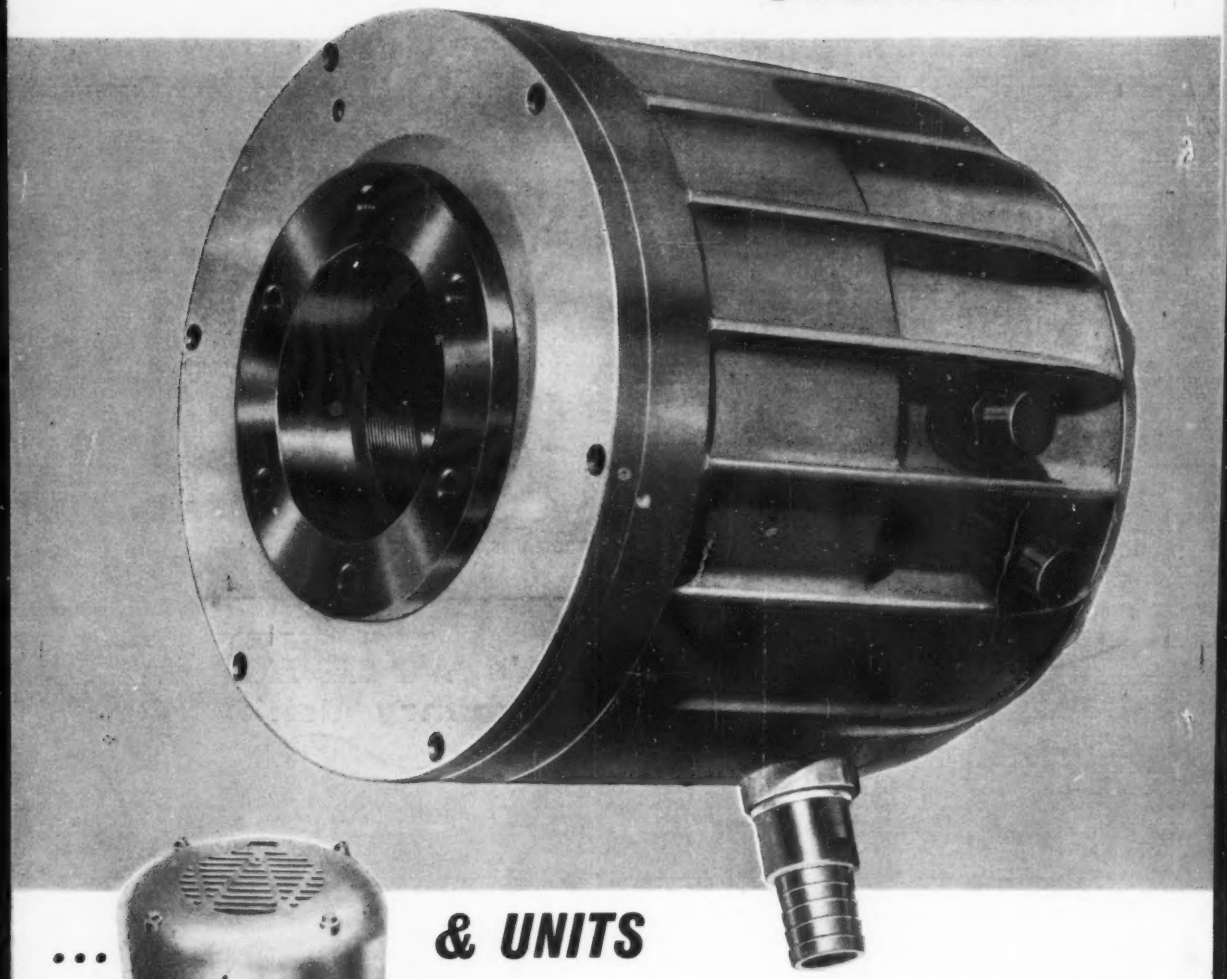

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